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DESCRIPTIONS OF SECTIONS AND SUBSECTIONS OF THAT PORTION OF THE NORTHERN ROCKY MOUNTAIN PHYSIOGRAPHIC PROVINCE CONTAINING THE IDAHO BATHOLITH

by
JOHN F. ARNOLD
1975

U.S.D.A. U.S. FOREST SERVICE

INTERMOUNTAIN REGION

THIS REPORT IS PART OF APPENDIX B OF THE IDAHO BATHOLITH SOURCE BOOK

A 6/00

Descriptions of Sections and Subsections of that Portion of the Northern Rocky Mountain Physiographic Province Containing the Idaho Batholith

by

John F. Arnold
1975
U.S. Forest Service

This report is part of Appendix B of the Idaho Batholith Source Book

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APPENDIX B

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A DESCRIPTION OF THE AREA OF CONCERN*

INTRODUCTION

Recognition has slowly come over the past 20 years that the ecosystem (the land) is the basic medium of management rather than the consumable and nonconsumable resources produced by the lands. With this understanding came the realization that decisionmaking processes dealt with essentially three data subsystems: the ecosystem (the land), the resources (consumable and nonconsumable), and the needs of people (economic, social, cultural). All three subsystems require inventory and interpretation systems (including predictive capabilities) if each is to receive its proper weight in the decisionmaking process.

The land (the ecosystem) itself is, in the last analysis, a complex of interdependent elements that can be defined hierarchically as holistic, four-dimensional systems when viewed from a defined perspective of time.

In the past, we have attempted to gain understanding by classifying and mapping each element that constitutes these holistic systems. We have come to find that often the whole (hence holistic) entity is either greater or performs differently than would have been predicted by simply adding up the elements. One of the problems is that the way the elements come together (their juxtaposition) often determines the character of the entity.

The Land System Inventory system proposed by Wertz and Arnold (1972) displays a stratification of the terrestrial environment into holistic entities at several categorical levels. Table I shows the varying units of time and space usually used to measure each categorical level in the system. The table also displays the basic and manifest elements used to differentiate units from another at the same categorical level, and shows how these characteristics are generally used at different categorical levels.

This system is not a full-blown classification (taxonomic) scheme. It is merely a scheme to stratify real pieces of the world into holistic, relatively homogeneous units at significant categorical levels. If we had a chance to look at a larger population other than that given us on this one planet--earth, if we could display the lands of several planets like earth, perhaps we could begin to define a legitimate criteria with which to build a taxonomy. In the meantime, the division, province, section, and usually subsection categories occur only in one place in the world--they do not repeat themselves with exactly the same characteristics. The system does, however, provide the basic requirements of a systematic language in that it provides a means of defining both a descriptive and a geographic address. These addresses are then available to use as a frame of reference to interpret, develop predictions for, and to inventory (count and measure).

*Also see Appendix B report.

The theoretical possibility of one missing categorical level should be noted here. For example, a large, very homogeneous subsection may well also define a section.

Efforts to characterize the ecosystem in the recent past have largely dealt with the problem on an element-by-element basis. The establishment of a Forest Service-wide soil survey program in 1957 is an example of such efforts. More recent attempts to identify and map plant associations by habitat types is another. A national "Eco-class" Task Force has been deliberating the establishment of a single ecological frame of reference for several years.

The element-by-element approach is difficult to deal with--each element uses its own set(s) of criteria, and when maps resulting from inventorying these elements are overlaid--one on the other--differences which appear on the map are often more apparent than real differences; a result stemming from differences in criteria and in the way similar criteria are used.

Initial soil survey efforts followed (by direction) largely traditional standard soil survey procedures which were initially developed for more gently sloping agricultural land using a taxonomy that is largely vegetatively biased. Soil surveys did not permit the identification of hazards that would accrue from bringing mountain slope lands under management. The hazards associated with mountain management are slope-forming and hydrologic processes oriented, having mainly to do with understanding of the slope's genetic background (including geologic character), its morphology, and its stage of development, so that the kinds and magnitudes of processes can be identified. Mapping entities like habitat types, in like manner, are vegetation oriented and address themselves mainly to the much needed identification of vegetation suitabilities and potentials, but again do not effectively deal with watershed management considerations.

Perhaps these considerations are more apparent by examining the display of the basic and manifest components of the ecosystem (Figure 1). It can be readily seen that trying to deal with an understanding of the ecosystem using an element-by-element approach is, to say the least, difficult, particularly if more than one level of generalization is to be addressed. Rules of planning state (see Planning Section and Basic Assumptions):

1. A stratification or classification scheme must be hierarchical to be systematic and;

2. The relationship to the level above and the level below must be understood and defined in a systems approach.

The Land Systems Inventory uses the basic and manifest elements (see Figure 1) of the ecosystem as differentiating characteristics and uses individual discipline languages of each component as descriptors of the entities delineated. A landtype is described in terms of its soils, habitat types, lithology characteristics, and landform and other physiographic features. The system permits the flexibility of subdividing landtypes into smaller categories on the basis of management needs.

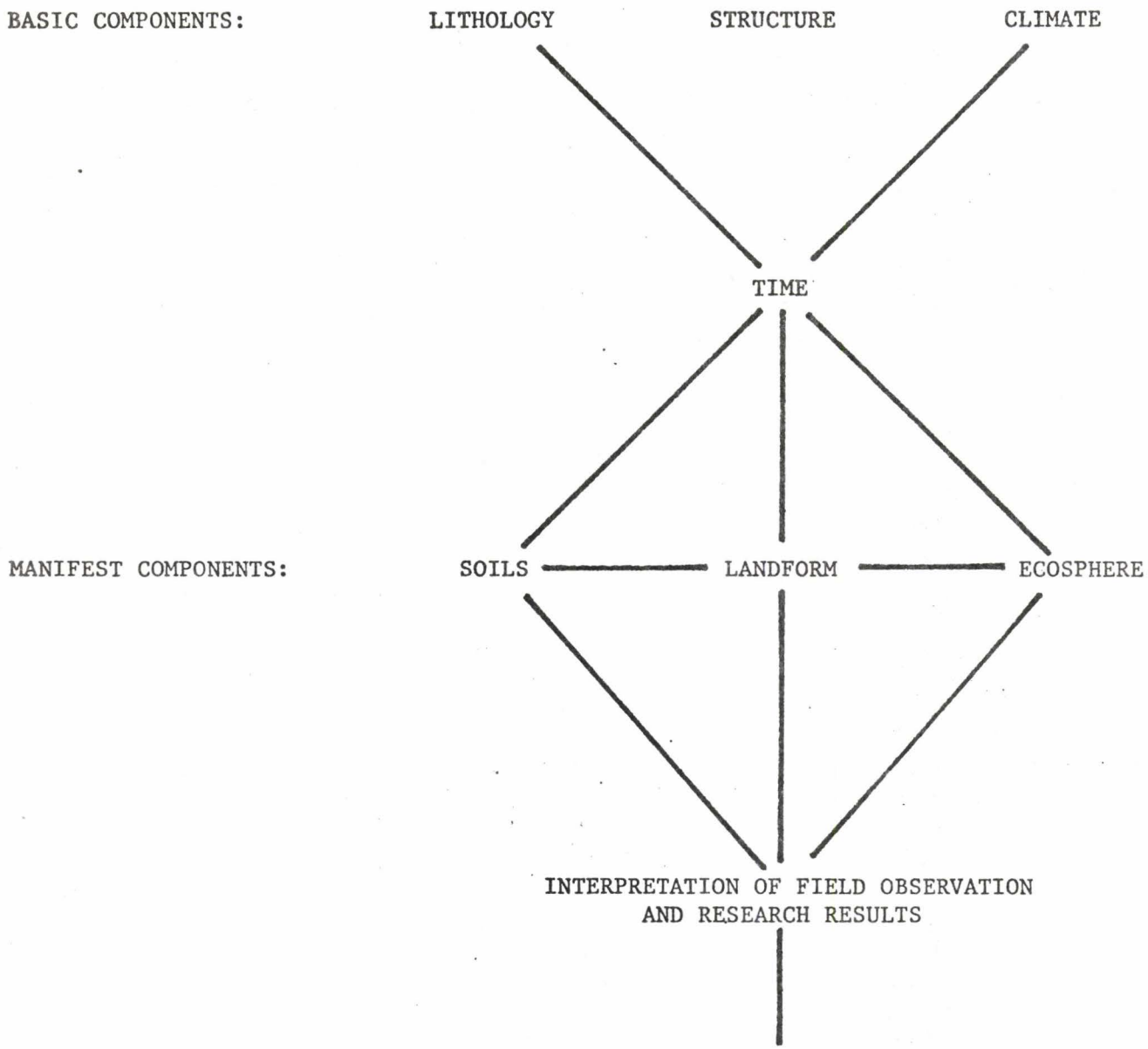
Table 1 shows that the section and subsection level is concerned with broad mantle and bedrock characteristics and it is not required to deal with precise characterization of soil profiles at these levels. Similarly, vegetation can be described in broader levels like formations, regions at the province level, regions and series at the section level, and series and habitat types at the subsection level. However, if more precise levels are known in an area, it is often useful to use a more precise level to identify relationships that are meaningful at that level.

Rules of planning (see Planning Section) say that the criteria used for a categorical level within a hierarchy should fit the entire body which it delineates, but description has to be done in terms of the largest elements which separate its internal parts.

So, as a rule of thumb, sections are best described in terms of their subsections; subsections in terms of their landtype association; landtype association in terms of its landtypes. The basic landtype is described in terms of the kinds and character of the landforms, soils, and vegetation which make it up--the distribution and relationships to each other; in other words, in terms of their manifest elements.

One of the first needs identified the first year (1968) of the Idaho Batholith program was a descriptive frame of reference against which experience, research results and other data bases could be evaluated and/or utilized, and priorities for filling information gaps and development of needed capabilities identified.

FIGURE 1-BASIC AND MANIFEST ELEMENTS OF THE LAND -- THE ECOSYSTEM



ADDENDUM 5

TABLE 1 - ESSENTIALS OF LAND SYSTEMS STRATIFICATION*

THE HIERARCHY			CHIEF BASES FOR SEPARATION						NORMAL UNITS OF MEASURE IN TIME AND SPACE		
Magnitude or Level	Category	Name	Climate*	Structure	Lithology	Landform	Soils	Biosphere	Age of Cycle	Depth (Feet)	Area (Sq. Miles)
1st	IX	DOMAIN	Subcontinental area of related climates; e.g., humid, temperate; dry, polar	Continental plate, Tectonic associated features	Large groups of formation sequences 4/	N/A	N/A	N/A except by chance	10^{9-10}	10^{5}	1,000,000's
2nd	VIII	DIVISION	Single regional climate at level of Koppens types; 2/ e.g., savanna, rain forest, semiarid steppe	Subcontinental dimentional features	Groups of formation sequences	N/A	N/A	Groups of dominant life forms	10^{8-9}	10^{4}	100,000's
3rd	VII	PROVINCE	Zonal vegetational region; 3/ e.g., laurentian mixed forest; shortgrass prarie	Regional dimensional features	Formation sequences	N/A	N/A	Dominant life forms	10^{7-8}	10^{3-4}	10,000's
4th	VI	SECTION	Climatic climax at formation level (Kuehler) 3/	Subregional kinds of dimensional features and dominant processes-Structures dominating base levels. Elevations-relief	Formations Groups of lithologies (Groups may be genetically induced.)	N/A	N/A	Life form associations	10^{6-7}	10^{2-3}	1,000's
5th	V	SUBSECTION	Groups of series (Daubenmeir) as controlled by local climate. Controlled by local relief features Elevation-aspect	Relief Dominant elevations Drainage patterns	Major kinds and distribution of rocks	Gross morphology and kinds of processes	N/A	Groups of associations	10^{5-6}	100's	10's-100's
6th	IV	LANDTYPE ASSOCIATION	N/A	Local control on stage of development Major processes	Kinds of rocks	Genesis and kinds of processes and distribution of morphology	Kinds and character of mantle	Associations	10^{4-5}	10's	1's-10's
7th	III	LANDTYPE	N/A	Local control on degree of development	Kinds and character of rocks	Magnitude of processes Stage of morphology	Parent materials and character of bedrock B horizon	Communities	10^{3-4}	1.5-10	.1's-1's
8th	II	LANDTYPE PHASE	N/A	N/A	N/A	Place (position) in morphology Macro-micro relief (Topo-sequences)	A & B horizon	Community phases	10^{2}	.5-1.5	.01's-.1's
9th	I	BASIC UNIT	N/A	N/A	N/A	Micro-relief Topo-sequence	A horizon and litter condition	Unions--Micro-communities and conditions	10's	.1-.5	.001's-.01's

*Arnold, Alvis, and Bailey--June 1975 (with significant review by Schlatterer and Larson)

1/ Classes of continental regime (by air masses).
2/ Available moisture, seasonal distribution of moisture, temperature patterns (growing season).
3/ Continentally induced climates (zonal).
4/ Formation(s) here include significant bodies of extrusive and intrusive bodies as well as sedimentary and metamorphic rocks.

Table 2. Estimated Occurrence of Granitic Bedrock[1/] within National Forests of Regions 1 and 4 (using 1969 Forest Boundaries).

National Forest	Gross area within Forest boundaries	Area within Batholith	Percent of gross Forest area within Batholith
	Acres	Acres	
Beaverhead[4/]	2,195,586	119,629	5.45
Bitterroot[3/]	1,650,503	983,886	59.61
Boise[2/]	2,954,346	2,531,738	85.70
Challis[2/]	2,467,910	449,219	18.20
Clearwater[2/]	1,761,744	1,186,523	67.35
Coeur d'Alene[5/]	802,277	14,648	1.83
Deerlodge[4/]	1,355,133	51,270	3.78
Kaniksu[5/]	1,844,748	383,301	20.78
Kootenai[4/]	2,092,051	17,090	0.82
Lolo[3/]	2,607,866	83,008	3.18
Nezperce[2/]	2,241,104	1,262,207	56.32
Payette[2/]	2,419,808	1,325,684	54.78
St. Joe[2/]	1,077,889	39,062	3.62
Salmon[2/]	1,790,999	444,336	24.81
Sawtooth[2/]	1,790,357	590,820	33.00

1/ Granitic rock includes all acid intrusive igneous rocks. These are dominantly light colored, and moderately coarse grained to coarse grained. Some darker and/or finer grained rocks are included.

2/ Idaho Batholith.

3/ Idaho Batholith and Boulder Batholith.

4/ Boulder Batholith.

5/ Kaniksu Batholith.

The first efforts of the Soil and Hydrology Survey Task Force reconnaissance concentrated on the development of land systems inventory to meet the needs of comprehensive multiple use planning and broad resource use and activity planning, although it was broadly understood that the level of generalization identified for the above purpose was part of a larger system: a system with levels above (more general) and at least one level below (more specific). This system, however, had never been described, either conceptually or specifically.

In 1969, R. J. Alvis and J. F. Arnold, on the basis of experience up to that time and a 50-hour aerial overview, identified the dominant association of landtypes that occurred in the major portion of the Idaho Batholith area (essentially from the North Fork of the Clearwater River to the South Fork of the Boise River and from the North Fork of the Payette River east to the Salmon River where it drains to the south).

At the time these associations were called geomorphic groups because they were grouped mainly by genetic characteristics (see Figure 2). No attempt was made in these early efforts to deal with the subregionalization problems even though they were recognized at the time.

Figure 2

MAIN GEOMORPHIC GROUPS
IN THE IDAHO BATHOLITH

GLACIATED LANDS

1. VERY STRONGLY GLACIATED LANDS.
   (GLACIAL SCOURED UPLANDS).
2. STRONGLY GLACIATED LANDS.
   (ALPINE GLACIATED VALLEY SYSTEMS)
3. FROST CHURNED (CRYIC) LANDS.
   (FORMERLY TERMED PERIGLACIATED, THEN CRYOPLANATED, THEN CRYOED LANDS)

   SUBDIVIDED BY STRENGTH OF EXPRESSION OF FROST CHURNING AND OTHER PERIGLACIAL PROCESS, PARENT MATERIALS, STEEPNESS OF SLOPE, RELIEF AND DEGREE OF DISSECTION.

FLUVIAL LANDS

1. SUBDIVIDED BY DEGREE OF DEVELOPMENT AND DISSECTION, SLOPE CLASS, AND IN SOME CASE GEOLOGIC AND MANTLE CHARACTERISTICS.
2. OTHER LANDS
   a. REJUVENATED CANYON LANDS.
      (MAY BE PARTIALLY CONTROLLED BY STRUCTURE)
   b. OLD LAND SURFACE REMNANTS.
      (MAY HAVE SOME DEPOSITIONAL MANTLE CHARACTERISTICS)

STRUCTURALLY MODIFIED LANDS

1. BASIN LANDS.
2. REJUVENATED UPLANDS.
3. FAULT LANDS.
4. OLD LAND SURFACE REMNANTS.

DEPOSITIONAL LANDS

1. STREAMS
2. LAKE
3. GLACIAL

Wertz and Arnold made a preliminary effort at building a conceptual model for the system in their publication "Land Systems Inventory" in 1972.

In his activities since 1973, the Batholith Liaison Officer, working with personnel on the Forests involved, stratified that portion of the Northern Rocky Mountain Physiographic Province into sections and subsections (according to Wertz and Arnold) and attempted to bring together descriptive data that would be germane at that level.

In 1974, Bob Steele and Ed Schlatterer summarized the distribution of habitat types for the lands south of the Salmon River. Earl Bennett's geology report was contracted for and received. Nelson Dean wrote a climatic and hydrology summary for the area. Landtype association legends were developed on the Boise, Salmon, and St. Joe National Forests. These sources, and in some cases, existing Reconnaissance Land Systems Inventories, served as the sources of information from which the generalized descriptions of the sections and subsections were generated. No attempt has been made in the text of the descriptions to consistently identify sources of information with an annotated bibliography. However, a list of sources is given at the end of the report.

It was not until 1974 that there was enough information available from which to synthesize a more or less systematic description of the section and subsection within the area of concern. All existing surveys were used to help synthesize the descriptions.

The descriptions in this report have not been standardized and should be considered nothing more than first approximations subject to improvement and redefinition. There are a number of reasons for variability in descriptions: (1) Availability of information varied from place to place; (2) help from Forests varied; and (3) form of information varied from place to place.

It should also be pointed out that in this initial effort to stratify the area of interest into sections and subsections, some practical mapping problems were encountered:

1. What to do with heterogeneous groups of land that do not reasonably fit in well-defined adjacent units (e.g., Trinity Mountain, Soldier Mountain Foothills Subsection). (Mapped Unit 2, Section I).

2. Natural variation in boundary definition. Some boundaries are more definitive than others. Some boundaries between sections, for example, may be transitional and actually be several miles wide. When this occurred, watershed boundaries were used. This often resulted in the same landtype or landtype association falling into two subsections. About the only way this situation can be rationalized is to permit landtypes or landtype associations to qualify as transitional boundaries.

3. The placement of narrow bands or small inclusions of contrasting lands in an adjacent unit because it is within the drainage affected by its processes; for example, the inclusion of the scarp slope of the uplifted horst with the basin floor of the graben as was done with the Long Valley and Bear Valley-Landmark Basin and Uplands Subsections.

4. Strongly expressed structural features that were small, contrasting and unique to surrounding units, e.g., Montezuma Fault Lands.

5. Strongly expressed extensive structural and erosional features that contained a narrow range of landtypes--but crossed boundaries of higher categorical levels. These are actually large landtype associations which, because of their size and variability of such things as bedrock and climate, assume many subsection-like attributes. The Salmon River Canyonlands Subsection is such a unit.

In this effort for the Idaho Batholith, Ross and Fenneman's physiographic divisions and provinces were used to deal with the subregionalization problem because they most nearly fit the requirements of the more general categorical levels as envisioned by Wertz and Arnold.

However, it is now apparent that using physiographic provinces is somewhat less than holistic. These units express very adequately the topography of a territory, its geologic structure and history, but only by accident, and consequently do not adequately consider the climate, nor take into account the present-day biological processes occurring at the surface.

As a result, the province is made to embrace heterogeneous terrain, quite diverse in respect to bioclimatic conditions. For instance, the Rocky Mountains: this unit, extending north and south for more than 5,000 miles, includes such different landscapes as the tundra, the boreal forest, broad-leafed forest, and the steppes. On the other hand, terrain which is similar in climate, vegetation, and soil cover (e.g., Eastern Decidious Forest), happens to be torn apart at the highest taxonomic levels between separate provinces. (See R. G. Bailey's map.)

For the past 3 years, Dr. Robert Bailey has been wrestling with the logic and systems of the higher categorical levels. He has effectively synthesized a holistic categorization at the domain, division, and province levels. Bailey has done this in a way that effectively deals with the identification of order problem that is so troublesome to the strictly physiographic approach. Based on the method proposed by Crowley (1967), he begins with climatic zones and adds vegetational and morphological criteria to delineate four domains, 21 divisions, and 48 provinces in descending order in North America. (See map and legend in Source Book.)

Table 1 and the thoughts expressed by Alvis on time-space relationships (Figure 3) together with Bailey's thoughts on zonality of factors in the ecosystem (Figure 4) should give the reader a better basis of understanding of the conceptual model of land systems being addressed in this work.

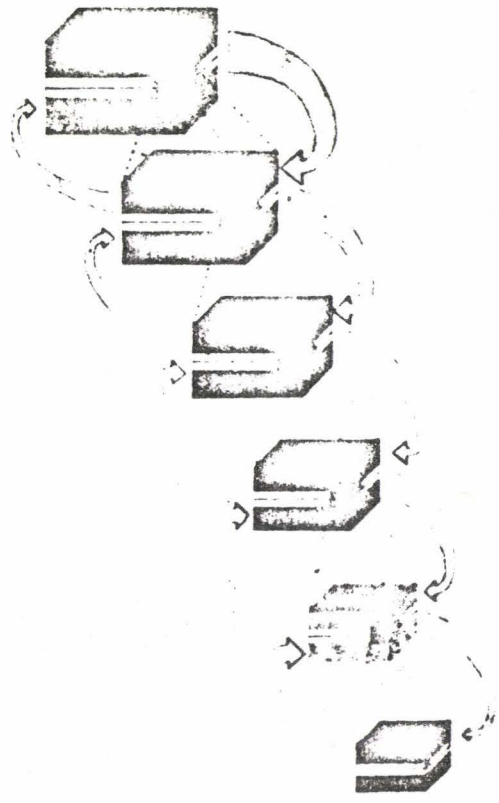
Some of the difficulties in developing a system to separate the world into holistic entities disappear when it is realized that any set of criteria devised is arbitrary and is only meant as a guide with which to actually inventory. It is almost never practical to apply such criteria strictly to the delineation or mapping process. It should be remembered that the purpose of mapping is inventory and that the inventory is not complete until the units mapped are described.

The sections and subsections as mapped for the Batholith should remain about the same. All that needs to be redescribed are the domain, division, and province levels, and the redistribution of the sections and subsection in this new perspective.

The descriptions attempt to describe the area at the province, section, and subsection levels as holistic entities. The text of the report contains only the province and section levels while Appendix B contains the subsection level as well.

FIGURE 3

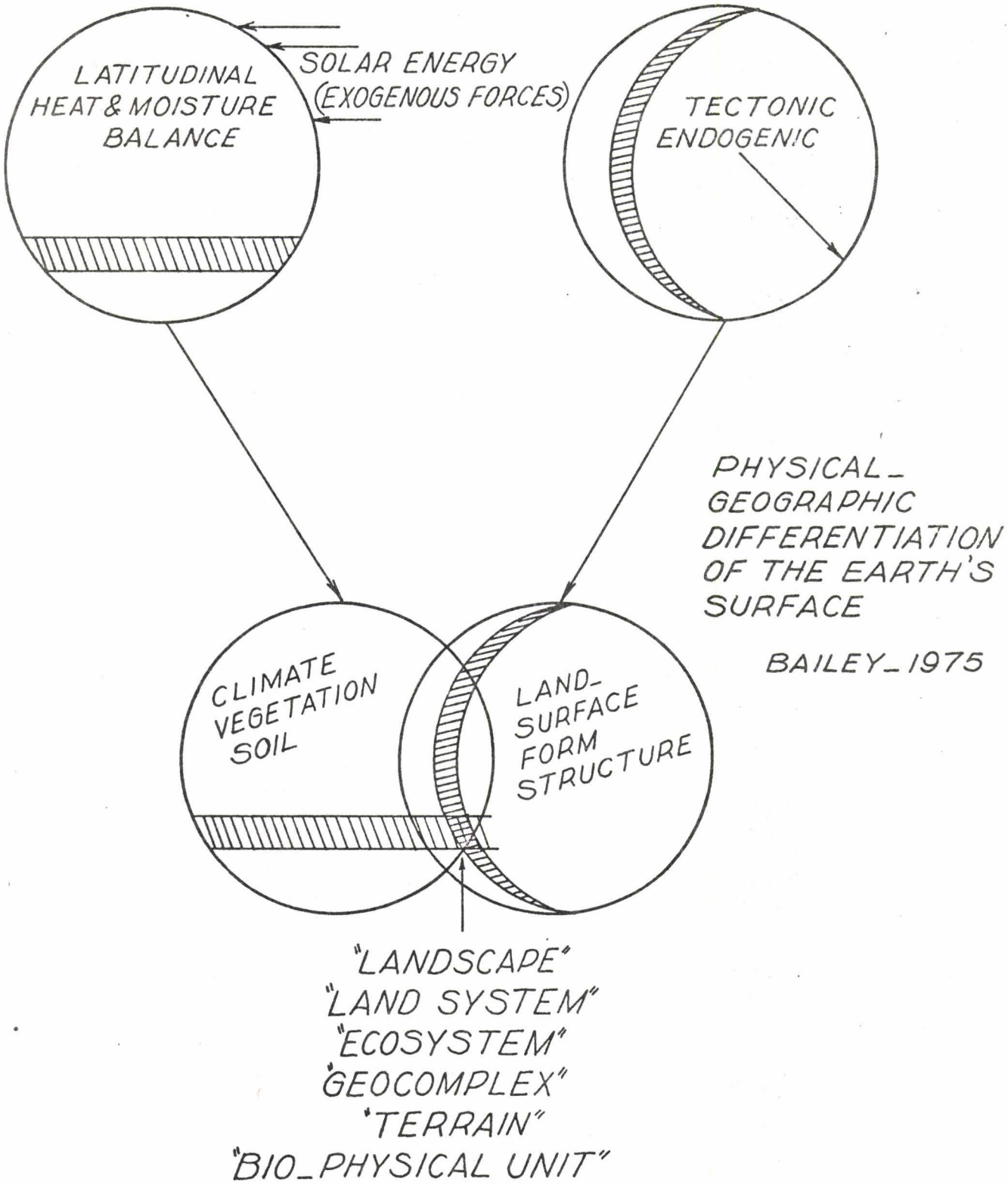
CATEGORY	NORMAL OCCURRENCE		
	DEPTH	LENGTH | BREADTH	AGE
PROVINCE	10^4 FT	10^3 MI^2	10^7 YRS
SECTION	10^3 FT	10^2 MI^2	10^6 YRS
SUBSECTION	10^2 FT	10 MI^2	10^5 YRS
LAND TYPE	10 FT	MILES^2	10^4 YRS
LAND TYPE PHASE	2-3 FT	10 ACRES	10^3 YRS
SITE	2-6 IN	0.1 ACRES	10^2 YRS



ZONAL FACTORS

FIGURE 4

AZONAL FACTORS



PHYSICAL-GEOGRAPHIC DIFFERENTIATION OF THE EARTH'S SURFACE

BAILEY-1975

H.C.

A DESCRIPTION OF THE AREA AT THE PHYSIOGRAPHIC PROVINCE LEVEL OF GENERALIZATION

This report focuses on that portion of the Northern Rocky Mountain Physiographic Province (to the nearest whole section) and the Idaho portion of the Wallowa-Seven Devils Sections (Columbia Intermontane Province) underlain in part by the Idaho Batholith. The area extends roughly from the Coeur d'Alene and St. Regis Rivers on the north to the South Fork of the Boise River on the south. Between these rivers, it is drained by the St. Joe, Clearwater, Lochsa, Selway, Bitterroot, Salmon, Payette, and Boise drainage systems. It is bounded on the west by the Columbia Intermontane Physiographic Province and on the east by the Open Northern Rockies Section of the Northern Rocky Mountain Province. The descriptions which follow are rough draft and subject to improvement and change.

Table 2 shows the area with granitic bedrock in the various National Forests in Idaho and part of Montana.

The map in the pocket at the back of this report shows the distribution of sections and subsections in the provinces in the area of concern at 1:1,000,000 scale. Copies of relief maps at 1:500,000 scale showing the same information will have limited distribution (Regional, Forest, and Research Unit distribution).

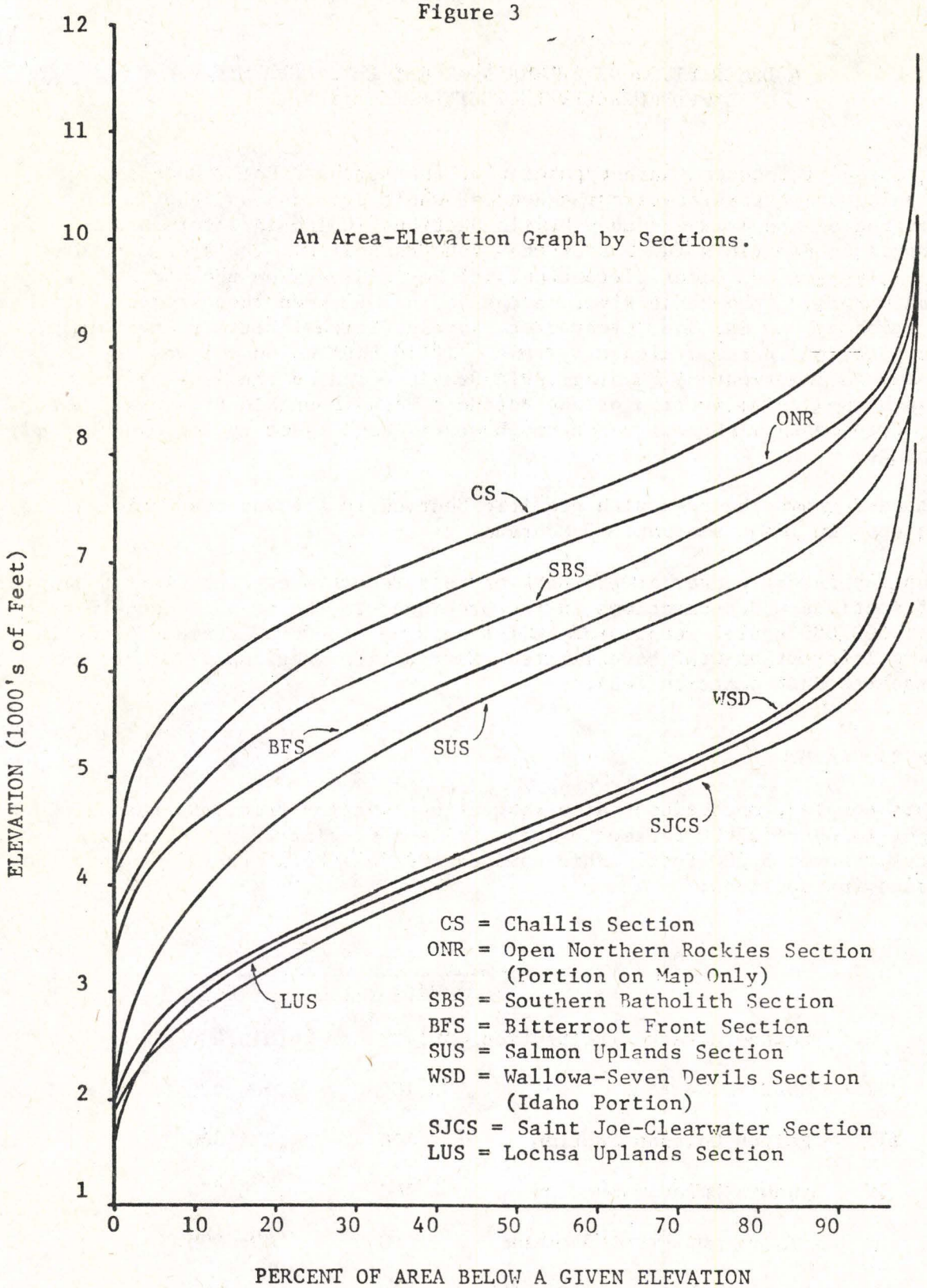
PHYSIOGRAPHY

This complex, mountainous area ranges in elevation from less than 2,000 feet to over 10,000 feet with local reliefs ranging from less than 1,000 feet to over 5,000 feet. This complex area has been stratified into the following sections:

		Area	
		Square Mi.	Acres
I.	Southern Batholith Section	9,400	6,016,000
II.	Challis Section	3,100	1,984,000
III.	Salmon Uplands Section	7,300	4,672,000
IV.	Lochsa Uplands Section	2,900	1,856,000
V.	Bitterroot Front Section	1,400	896,000
VI.	St. Joe-Clearwater Section	4,900	3,136,000
		29,000	18,560,000

Figure 3 roughly shows the distribution of area by elevations for most of the sections in the area.

Figure 3


An Area-Elevation Graph by Sections.
ELEVATION (1000's of Feet)
12
11
10
9
8
7
6
5
4
3
2
1
0
10
20
30
40
50
60
70
80
90
PERCENT OF AREA BELOW A GIVEN ELEVATION
ONR
CS
SBS
WSD
BFS
SUS
SJCS
LUS
CS = Challis Section
ONR = Open Northern Rockies Section
(Portion on Map Only)
SBS = Southern Batholith Section
BFS = Bitterroot Front Section
SUS = Salmon Uplands Section
WSD = Wallowa-Seven Devils Section
(Idaho Portion)
SJCS = Saint Joe-Clearwater Section
LUS = Lochsa Uplands Section

STRUCTURE

The area, including the drainages, seems to be controlled by gross structural features. For example, the general uplift on the south is largely compensatory to the Snake River downwarp and controls most of the drainage patterns for the interior of the entire Southern Batholith Section. The exceptions to this are the large north-south trending fault systems such as Long Valley, Deadwood, and Sawtooth which also control stream direction. This general north-south trending fault system, together with bedrock and climate, are the chief characteristics separating the transitional Challis Section from the Southern Batholith Section on the west, and the Northern Open Rockies on the east. The Salmon River Uplands Section and the Lochsa Upland Section show strong relationships to the "old erosion surface" so well recognized in the literature. (See pp. 149-153 Geology Appendix.) The Bitterroot Front Section is controlled by the Bitterroot Fault. The trans-Idaho discontinuity is largely responsible for the character and direction for most mountain ranges and drainage systems in the area in the St. Joe-Clearwater Section.

LITHOLOGY

The Idaho geology map identifies 10 major geologic units within the area. Bennett (see Geology Report in Appendix) discussed these in terms of sedimentary and metamorphic rocks, extrusive igneous rocks and intrusive igneous rocks (the group which contains the granitic rocks of the Idaho Batholith). Bennett is paraphrased as follows:

Sedimentary and Metamorphic Rocks

There are four major units of sedimentary rocks (and their metamorphic equivalents) which, for the most part, border the Idaho Batholith. Precambrian sediments and their metamorphic equivalents (mainly the Belt Super Group) are located mainly in the St. Joe-Clearwater Section, the Lochsa Uplands Section and, to a somewhat lesser extent, in the Salmon River Uplands Section and the Bitterroot Front Section. In places where they have been metamorphically altered by the intrusion of the Idaho Batholith, they are known locally as "border zone rocks." These are best expressed north of the Main Salmon River, downstream from the confluence of the Main and the South Fork of the Salmon, to the lower Clearwater drainage in the Salmon Uplands and Lochsa Uplands Sections.

Palezoic sediments ranging in age from Cambrian to Permian are found in the east-central and southeastern portion of the area mainly in the Challis Section and the Bighorn Crags and Panther Creek Basin Subsections of the Salmon Uplands Section.

Mesozoic age sediments are well represented in the west-central and southwestern portion of the area in association with the Permian-Triassic Seven Devils Volcanics, mainly in the Idaho portion of the

Wallowa-Seven Devils Section, but also in the western portion of the Salmon River Canyonlands Subsection and the Granite Mountain Uplands Subsection of the Salmon Uplands Section. Cenozoic sediments are mainly in the Idaho portion of the Wallowa-Seven Devils Section.

Extrusive Igneous Rocks

There are four major groups of extrusive igneous rocks represented in the area:

1. Snake River basalts - Mainly occupying the canyons and lowlands in areas of the southernmost part of the Southern Batholith Section.

2. Columbia River basalt - Occupies much of the entire western boundary of the portion of the Northern Rocky Mountain Province under consideration. Columbia River Basalt is also the bedrock of most of the area of the Idaho portion of the Wallowa-Seven Devils Section as well as in the Baby Grand Subsection of the St. Joe-Clearwater Section. Small areas are also fairly common in some of the western-most subsections.

3. Challis Volcanics - Located mainly in the Challis Section but also are in the Profile-Monumental and Upper Middle Fork Salmon River Canyon and Streamcut Subsections of the Southern Batholith Section, as well as in the Panther Creek Subsection of the Salmon Rivers Upland Section.

4. The Seven Devils Volcanics - Found chiefly in the Idaho portion of the Wallowa-Seven Devils Section.

Intrusive Igneous Rocks

There are three major groups of intrusive igneous rocks: (1) the Batholith complex itself; (2) younger, smaller (Tertiary) plutons; (3) dike swarms.

The Idaho Batholith Complex is represented in all Sections and is the dominant rock in the Southern Batholith, the Salmon Uplands, the Lochsa Uplands, and the Bitterroot Front Sections. Larsen and Schmidt (1958), in their reconnaissance of the Idaho Batholith, reported the following distribution of granitic rocks in the Idaho Batholith:

Rock type	Percent of batholith	Estimated area (sq mi)	Remarks
Quartz gabbro----------	1.0	40	Northeast of Grangeville
Tonalite (Quartz Diorite)-	9.0	1,500	Chiefly in north half of batholith
Granodiorite:			
Cascade type----------	11.0	1,800	South of Cascade
Atlanta type----------	12.5	2,000	Boise River
Fine-textured quartz monzonite----------	25.0	4,000	Chiefly in eastern part of batholith. In part belongs to younger batholith.
Fine dark quartz monzonite----------	2.0	300	Elk City area
Coarse quartz monzonite---	37.5	6,000	Chiefly in southwestern part of batholith
Microgranite----------	1.0	40	Chiefly in northeastern part of batholith
Porphyroblastic gneiss----	2.5	400	Chiefly in north half of batholith

Areas underlain by subdivisions of the Idaho Batholith after Larsen and Schmidt (1958).

Generally the more mafic (basic) and older rocks lie at the western edge of the Batholith while the rocks are progressively more felsic (acid) and younger to the east.

The Idaho Batholith is an igneous complex which outcrops more or less continuously across Idaho for about 250 miles in a north-south direction and for about 90 miles in an east-west direction. It is a member of a chain of batholiths which extend along the western border of North America. The chain includes the Southern California Batholith and the Sierra Nevada Batholith in California, the Central Nevada intrusive belt, the Idaho Batholith, the Colville (Kaniksu) Batholith in Washington, and the Coast Range Batholith complex of Canada and Alaska. Smith et al. (1971) believe that the Sierra Nevada and the Idaho Batholith are connected via the Central Nevada intrusive belt. Larsen et al. (1958) and R. Armstrong (Per. Comm.) have dated the Idaho Batholith at 90-110 million years which is Late Cretaceous.

Although the origin of the Idaho and other Batholiths is still being studied, Bennett summarizes its origin in the following manner:

> In summary, the Idaho batholith may have formed in the following way. The original batholith magma was produced in an active subduction zone. The source of this magma could have been differentiated mantle material or fused lower continental crust or a combination of these. Anatexis of eugeosynclinal sediments may have also produced part of the magma. As the magma was generated, it rose through the crust probably as individual pods which when reaching shallow depths coalesced and spread out as a thin, sheetlike batholith. This sheetlike batholith was passively emplaced but as the magma differentiated in place new magmas were formed which were volatile charged and this magma was then forcibly emplaced. The Idaho batholith essentially fits the Hamilton-Myers' model. More evidence of this will be presented in the section-subsection discussions.

Classification of the above granitic rocks is based mainly on amounts and kinds of feldspars, amount of quartz, amount and presence of darker minerals, texture, and degree of orientation.

In his work in a 157 square-mile area, Bennett found as much variation in granitics as did Ross' (1963) analysis of the entire Batholith. This high variability and field performance experience led to the conclusion that, in most cases, the degree of weathering and fracturing had more to do with performance than the minor mineralogical differences between the major kinds of rocks in the Idaho Batholith (quartz monzonite and granodiorite). In 1972 Clayton and Arnold proposed a rock weathering and fracturing key which has been supported by subsequent rock weathering research efforts and slope stability experience (see characterization research).

The following is taken directly from Clayton and Arnold's 1972 technical report -- Practical Grain Size, Fracturing Density, and Weathering Classification of Intrusive Rocks of the Idaho Batholith:

The Key lists five fracture density classes. The criterium for each class is simply the distance between strongly expressed fractures or joints. The authors realize that there are several characteristics of fractures (e.g., direction of strike, amount and direction of dip, and amount of separation between the two sides of fractures) that are not considered. Only the density of fractures was classified for easy use of the Key. If fracture planes are visible in two or more dimensions, a compromise value is usually taken, unless it is apparent that one plane is more important than the other to slope performance.

Class	Distance between fractures (ft.)	(cm.)	Density
1	6	180	Very low
2	4 to 6	120 to 180	Low
3	1.5 to 4	45 to 120	Medium
4	.5 to 1.5	15 to 45	High
5	.5	15	Very high

The rock weathering portion of this Key, the most complex part, includes seven classes of rock weathering. Weathering produces both physical and chemical alterations in granitic rocks, including changes in the following:

1. The amount of iron removed from minerals (e.g., biotite) and deposited as iron oxide stains on mineral grains.

2. The degree of interstitial fractures (between mineral grains).

3. The degree of fracturing to "hand-size" (5-10 cm.) fragments.

4. The degree of chemical alteration of biotites and feldspars to secondary minerals.

The weathering index was based on observations of the following:

1. Change in rock color from that of the unweathered condition.

2. Mechanical strength of rock (how easily it can be broken manually).

3. Ease of root penetration--whether roots penetrate the rock matrix or fractures.

4. How distinctly original jointing is preserved.

5. The sound a rock hammer makes when striking the rock.

6. Whether the rock is spalling (crumbling).

7. Whether the rock is plastic in nature when wet.

Rock was grouped into seven classes of weathering as follows:

Class 1, Unweathered Rock[2/].--Unweathered rock will ring from a hammer blow; cannot be dug by the point of a rock hammer; joint sets are the only visible fractures; no iron stains emanate from biotites; joint sets are distinct and angular; biotites are black and compact; feldspars appear to be clear and fresh.

Class 2, Very Weakly Weathered Rock.--Very weakly weathered rock is similar to class 1, except for visible iron stains that emanate from biotites; biotites may also appear "expanded" when viewed through a hand lens; feldspars may show some opacity; joint sets are distinct and angular.

Class 3, Weakly Weathered Rock.--Weakly weathered rock gives a dull ring from a hammer blow; can be broken into "hand-sized" rocks with moderate difficulty using a hammer; feldspars are opaque and milky; no root penetration; joint sets are subangular.

Class 4, Moderately Weathered Rock.--Moderately weathered rock may be weakly spalling; except for the spall rind, if present, rock cannot be broken by hand; no ring or dull ring from hammer blow; feldspars are opaque and milky; biotites usually have a golden yellow sheen; joint sets indistinct and rounded to subangular.

Class 5, Moderately Well Weathered Rock.--Moderately well weathered rock will break into small fragments or sheets under moderate pressure from bare hands; usually spalling; root penetration limited to fractures unlike Class 6 rock where roots penetrate through the rock matrix; joint sets are weakly visible and rounded; feldspars are powdery; biotites have a light golden sheen.

Class 6, Well Weathered Rock.--Well weathered rock can be broken by hand into sand-sized particles (grus); usually so weathered that it is difficult to determine if rock is spalling, roots can penetrate between grains; only major joints are preserved and filled with grus; feldspars are powdery; biotites may appear silver or white in thin flakes.

2/ This class is rare in the Idaho Batholith and probably limited to glacially soured or rejuvenated landscapes.

Class 7, Very Well Weathered Rock.--Very well weathered rock has feldspars that have weathered to clay minerals and rock is plastic when wet; no resistance to roots.

Younger, Smaller (Tertiary) Plutons. A series of intrusive Tertiary plutons outcrop within the Idaho Batholith. These plutons include the Sawtooth Batholith, the Casto Pluton, the Crags Pluton, and several unnamed plutons in the Selway-Bitterroot area. With the exception of the Crags Pluton which is gray quartz monzonite, they are generally pink, leucocratic, quartz monzonite. This pink color makes them quite distinctive in the field. The relationship of these Tertiary plutons to the Idaho Batholith (Late Cretaceous) is not known. The Sawtooth Batholith, however, contains a very large zenolith of schist. The Idaho Batholith in this area has very few zenoliths of any kind. It seems probable that if emplaced as a sheet, it would contain few zenoliths, but later Tertiary intrusions could penetrate the sheet with basement zenoliths from below.

Intrusive dike swarms are associated with the Tertiary plutons. These dikes vary compositionally from lamprophyres (ultramafic) to granophyres (granitic). The bulk seem to be prophyritic latites or andesites. The relationship of the dikes and the plutons are discussed in Geologic Report Appendix B. However, it should be noted that these dikes are reported from widespread areas of the province and must collectively represent a considerable quantity of magma.

VEGETATION

The hierarchy for vegetation presently being used by the Intermountain Station blends Kuchler's Formations and Regions with Daubenmire's Series and Habitat Types. See the following figure which shows dominant series by Sections.

DOMINANT SERIES BY SECTION

		Approximate Proportion of Occurrence	Main Sections of Occurrence
1.	Formation-Region-Series Alpine Formation		
	A. Alpine Region	Trace	I, II, V
2.	Grassland Formation	Trace	I, VIII
	A. Steppe Grassland Region	Trace	I, VI(9), VIII
	B. Montane Grassland Region	5%	I, II, III, V, VI
3.	Shrubland Formation	20%	
	A. Chaparral Formation	None	
	B. Steppe Shrub Formation	5%	VIII, I, VI(9)
	C. Montane Shrub Region	15%	All
4.	Woodland Formation	None	
	A. Coniferous Woodland Region	None	
	B. Deciduous Woodland Region	None	
5.	Coniferous Forest Formation	80%	
	A. Montane Taigia (Subalpine) Region	15%	All (but series change)
	B. Temperate Mesophytic Forest Region	45%	All (but series change)
	C. Temperate Xerophytic Forest Region	20%	All (but series change)
6.	Deciduous Forest Region		
	A. Temperate Mesophytic Forest Region	Trace	

The distribution of series within regions changes drastically from north to south. For example, Cedar and Hemlock series are rare in sections south of the Salmon River. In like manner, some habitats within series disappear from north to south and to a lesser extent, from east to west. For example, subalpine fir/beargrass and subalpine fir/menziesia extend into the Southern Batholith Section only a short distance and the grand fir habitat types become uncommon going east in the Southern Batholith Section. Going east across the Southern Batholith Section, the distribution of the more xeric habitat types within series tends to increase and some of the more xeric Douglas fir series tend to replace for the ponderosa pine series and new habitat types begin to crop up. Appendix X shows the hierarchical classification for formations, regions and proposed series in five northwestern states.

SOILS

Soils in the area vary considerably depending upon the combination of parent materials, climate, geomorphic features, and vegetation. At the physiographic province level of generalization, only gross mantle characteristics need be addressed. Soil texture has some general relationships to parent material. These are shown in the next table.

Aeolean materials form caps from 1/2 foot to as much as 2 1/2 feet thick over large portions of the area, mainly north of the Salmon River in the Salmon Uplands, Lochsa Uplands and St. Joe-Clearwater Sections. These so-called "loess-caps" are dominantly silt loams, but may be very fine sandy loams in places. Coarse fragment content of reseeded soil mantles varies. The stoniest mantles are associated with weakly weathered, well fractured bedrock. Strongly colluvial slopes below steep headlands are also generally stony. Soils from quartzites, basalts, limestones, sandstones and competent granitics are generally stony. Soils on Depositional, Glacial, and Frost Churned Landtype Associations are often stony.

The variability in soil depth is chiefly a function of soil genesis and slope. In the Fluvial Landtype Association, for example, soils 20 inches or less to bedrock are restricted to the extremely steep rejuvenated slopes, with south slopes tending to be more shallow than north slopes.

Structure of the surface soils tends to be very weakly expressed. In granitic parent materials the soils are almost single-grained, both in the surface and subsurface layers.

Table 2

Parent Materials	Dominant Soil Textures	
Intrusives	Surface	Subsurface
Granitic except weathering class 7	Sandy loams to loamy sands[1/] loams	Sandy loams to loamy sands Heavy loams to clay loams
Intermediate Dikes	Sandy loams to loams	Sandy loams
Tertiary granitics	Gravelly to stony loamy sands	Gravelly to stony loamy sands
Extrusives		
Basalts	Loams	Heavy loam to clay loams
Challis Volcanics	Loams	Heavy loam to clay loams
Seven Devils Volcanics	Loams	Heavy loam to clay loams
Sedimentary Metamorphics		
Sandstones	Sandy loam	Sandy loam-sandy clay loam
Phylltes	Loam-silt loam	Heavy loam to silty clay loam
Schists	Loam-silt loam	Heavy loam to silty clay loam
Siltstones	Silt loam	Heavy silt loam
Quartzites	Loamy sand to sandy loam	Loamy sand to sandy loam
Limestones	Loam	Heavy loam to clay loam

1/ Clay plus silt content are generally low - ranging from 5-15%. Moisture availability of surface soils range from .7 to 1.7 inches/foot of depth.

Table 3 gives the extent, distribution, and soil classification at the Great Group level for the soils of the Region 4 portion of the study area. Data is not yet available for the Region 1 portion.

Table 3

Classification,* Extent, and Distribution of Soils in the Study Area

Northern Rocky Mountain Physiographic Province
Section I - Southern Batholith

Great Group	Extent	Distribution
Alfisols	Minor	
Cryoboralfs	Minor	Central portion, mid elevations, timbered slopes
Haploxeralfs	Minor	Southern portion, low elevations, open slopes
Entisols	Major	
Cryorthents	Major	Throughout mid and high elevations, all aspects
Udorthents	Minor	Southern half, low elevations, timbered slopes
Xerorthents	Moderate	Throughout low elevations, open slopes
Crypsamments	Minor	Throughout mid elevations, timbered slopes
Xeropsamments	Moderate	Throughout low elevations, open slopes
Inceptisols	Major	
Cryochrepts	Major	Throughout mid and high elevations, timbered slopes
Cryumbrepts	Moderate	Throughout mid elevations, timbered slopes, high elevation open slopes
Haplumbrepts	Minor	Southern portion, mid elevations, timbered slopes
Xerumbrepts	Minor	Southern portion, low and mid elevations, open slopes
Mollisols	Moderate	
Cryoborolls	Moderate	Throughout mid and high elevations, open slopes
Argixerolls	Minor	Southern portion, low elevations, open slopes
Haploxerolls	Moderate	Southern portion low elevations, open slopes

Section II - Challis

Great Group	Extent	Distribution
Alfisols		
Cryoboralfs	Moderate	Throughout mid and high elevations, timbered slopes
Entisols		
Cryorthents	Major	Throughout high elevations, all aspects
Xerothents	Moderate	Throughout low elevations, open slopes
Inceptisols	Major	
Cryochrepts	Major	Throughout high elevations, timbered slopes
Xerochrepts	Minor	Throughout low and mid elevations, open slopes
Cryumbrepts	Minor	Throughout high elevations, open slopes
Mollisols	Major	
Argiborolls	Minor	Throughout low elevations, open slopes
Cryoborolls	Major	Throughout mid elevations, all aspects
Argixerolls	Moderate	Throughout low elevations, open slopes
Haploxerolls	Major	Throughout low elevations, open slopes

Section III - Salmon River Uplands
Region 4 portion only

Great Group	Extent	Distribution
Entisols	Major	
Cryorthents	Major	Throughout high elevations, timbered slopes
Cryopsamments	Moderate	Throughout high elevations, timbered slopes
Xeropsamments	Moderate	Throughout low elevations, open slopes
Inceptisols	Major	
Cryochrepts	Major	Throughout high elevations, timbered slopes
Cryumbrepts	Minor	
Mollisols	Minor	
Cryoborolls	Minor	Throughout mid elevations, open slopes
Hapludolls	Minor	Throughout low elevations, open slopes

Section VII - Wallowa-Seven Devils

Great Group	Extent	Distribution
Alfisols	Minor	
Cryoboralfs	Minor	Throughout mid elevations, timbered slopes
Glossoboralfs	Minor	Throughout low elevations, timbered slopes
Entisols	Major	
Cryorthents	Major	Throughout mid and high elevations, timbered slopes.
Inceptisols	Major	
Cryochrepts	Major	Throughout mid and high elevations, timbered slopes
Cryumbrepts	Major	Throughout mid elevations on timbered slopes, high elevations, open slopes
Mollisols	Moderate	
Argiborolls	Moderate	Throughout mid elevations, all aspects
Cryoborolls	Moderate	Throughout mid and high elevations, all aspects
Haploborolls	Moderate	Throughout low elevations, open slopes
Argixerolls	Moderate	Throughout low elevations, all aspects

* According to the new soil taxonomy.

CLIMATE

There are many contrasting climatic regimes within the area. Common characteristics include cool moist winters from about November 1 to April 1, and a hot, relatively dry July to September. Moderate precipitation generally occurs during the intervening months of October, May, and June. Most annual precipitation occurs as snow with maximum snow accumulations between March 1 and April 15.

There are definite regional patterns in climate. A strong maritime influence in the St. Joe-Clearwater and Lochsa Uplands Sections decreases in influence across the transitional Salmon Uplands Subsection to the largely orographic influence on the Southern Batholith and Challis Sections. Gulf storm patterns generate hot, dry southerly winds and summer thunderstorms in the southern part of both sections.

As a result of orographic lifting, mean annual precipitation varies as much as 45 inches within some subsections, causing "rainshadow" effects in several sections.

Large, long duration storms are rather common in the winter as the result of moist, warm, unstable air from the Pacific. They often cause floods as in 1948, 1952, 1955, and 1965. When these occur in conjunction with melting of antecedent snow, sedimentation and flood damage are especially high.1/

The following tables and figures are from Dean's (see Appendix B) climate and hydrologic characteristics data prepared for this Source Book.

Table 4 - Average Annual Precipitation, Runoff, and Evapotranspiration by Sections.

Table 5 - Average Annual and Annual Variation of Precipitation and Runoff by Sections.

Table 6 - Precipitation Distribution by Months by Sections.

Table 7 - Average and Variation of Precipitation Intensity from a 2-Year 24-Hour Storm by Sections.

Table 8 - Average Annual Maximum, Mean, and Minimum Air Temperatures at the Median Elevation by Sections.

Table 9 - Streamflow Data for Main Streams Draining the Idaho Batholith.

Figure 5 - April Snowpack Water Equivalent-Elevation Relationship for Five Sections Containing the Idaho Batholith.

Figure 6 - Average Annual Temperature-Elevation Relationship for the Sections Containing the Idaho Batholith.

1/ The preceding discussion is largely from Megahan's 1969 Analysis of Four Selected Idaho Batholith Problems.

Table 4

Average Annual Precipitation, Runoff, and Evapotranspiration
by Sections

Section	Ave. Ann. Precipitation		Ave. Ann. Runoff			Ave. Ann. Evapotranspiration		
	(1000's A-F)	(Area-In.)	(1000's A-F)	(Area-In.)	(%)	(1000's A-F)	(Area-In.)	(%)
Bitterroot Front	3,519	47.13	2,177	29.15	61.9	1,342	17.98	38.1
Lochsa Uplands	7,461	48.24	4,097	26.49	54.9	3,364	21.75	45.1
Saint Joe-Clearwater	12,204	46.70	6,831	26.14	56.0	5,373	20.56	44.0
Challis	3,521	21.30	1,248	7.55	35.4	2,273	13.75	64.6
Salmon Uplands	12,155	31.22	5,303	13.62	43.6	6,852	17.60	56.4
Southern Batholith	11,798	32.06	5,494	14.93	46.6	6,304	17.13	53.4
Upper Middle Fork Salmon	15,939	31.56	7,106	13.51	42.8	8,833	18.05	58.8
Totals	54,799	35.43	26,762	17.30	48.9	28,037	18.13	51.1

Table 5

Average Annual and Annual Variation of Precipitation and Runoff by Sections

Section	Annual Precipitation			Annual Runoff		
	Lowest* (In.)	Average (Area-In.)	Highest* (In.)	Lowest* (In.)	Average (Area-In.)	Highest* (In.)
Bitterroot Front	21	47.13	73	1	17.98	64
Clearwater Uplands	25	48.24	62	4	21.75	53
Saint Joe-Clearwater	19	46.70	73	1	20.56	65
Challis	9	21.30	47	1	13.75	25
Salmon Uplands	9	31.22	51	1	17.60	44
Southern Batholith	14	32.06	57	1	17.13	38

*The lowest or highest value occurring within a section as depicted on the respective isohyetal or isohyetal or isofluvial map.

Table 6

Precipitation Distribution by Months by Sections

Precipitation Distribution — Percent of Total / Area-Inches

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Bitterroot Front	7.7	7.5	6.0	6.1	12.6	14.4	6.9	5.3	7.9	7.9	8.7	9.0	100.0
	3.63	3.53	2.83	2.88	5.94	6.79	3.25	2.50	3.72	3.72	4.10	4.24	47.13
Clearwater Uplands	12.3	10.8	10.3	8.6	7.3	7.0	2.2	2.6	5.0	8.3	12.0	13.6	100.0
	5.93	5.21	4.97	4.15	3.52	3.38	1.06	1.26	2.41	4.00	5.79	6.56	48.24
Saint Joe-Clearwater	12.9	10.7	9.9	7.2	6.3	6.9	2.4	2.6	5.2	9.2	12.6	14.1	100.0
	6.02	5.00	4.62	3.36	2.94	3.22	1.12	1.21	2.43	4.30	5.89	6.59	46.70
Challis	12.1	10.4	8.0	6.9	11.2	9.6	4.8	4.5	5.7	6.7	8.4	11.7	100.0
	2.58	2.22	1.70	1.47	2.39	2.04	1.02	0.96	1.21	1.43	1.79	2.49	21.30
Salmon Uplands	10.1	8.5	9.0	8.5	11.4	10.5	3.3	4.5	5.4	8.3	10.0	10.5	100.0
	3.15	2.65	2.81	2.65	3.56	3.28	1.03	1.41	1.69	2.59	3.12	3.28	31.22
Southern Batholith	14.0	11.7	10.4	7.7	8.6	7.3	2.2	2.7	4.0	7.4	10.3	13.7	100.0
	4.42	3.68	3.29	2.41	2.70	2.30	0.71	0.85	1.28	2.33	2.71	4.35	31.55

Table 7

Average and Variation of Precipitation Intensity from a 2-Year 24-Hour Storm by Sections

Section	2-Year 24-Hour Intensity		
	Lowest* (In./Hr.)	Average (Area-In./Hr.)	Highest* (In./Hr.)
Bitterroot Front	1.4	2.2	2.6
Lochsa Uplands	1.5	2.2	2.6
Saint Joe-Clearwater	1.4	2.2	2.7
Challis	0.9	1.7	2.5
Salmon Uplands	0.9	1.7	2.5
Southern Batholith	1.1	1.8	2.4

*The lowest and highest rate occurring within a section as depicted on the 2-year 24-hour precipitation-frequency map.

Table 8

Average Annual Maximum, Mean, and Minimum Air Temperatures
at the Median Elevation by Sections

Section	Median Elevation (Feet)	Elevational Relief (Feet)	n*	Average Annual Air Temperature (F.) Max.	Mean	Min.	Max.-Min.
Bitterroot Front	6200	7400	2	49.3	36.0	22.1	27.1
Clearwater Uplands	4400	6800	6	53.1	40.0	25.7	27.4
Saint Joe-North Bitterroot	4300	5000	13	52.5	40.7	28.7	23.8
Salmon-Challis-Ketchum	7400	8000	8	49.9	33.9	18.0	31.9
Salmon Uplands	5900	8000	12	50.7	37.0	22.4	28.3
Southern Batholith	4500	6750	19	51.0	36.3	21.7	29.4

*The number (n) of temperature stations utilized in quantifying average annual air temperature.

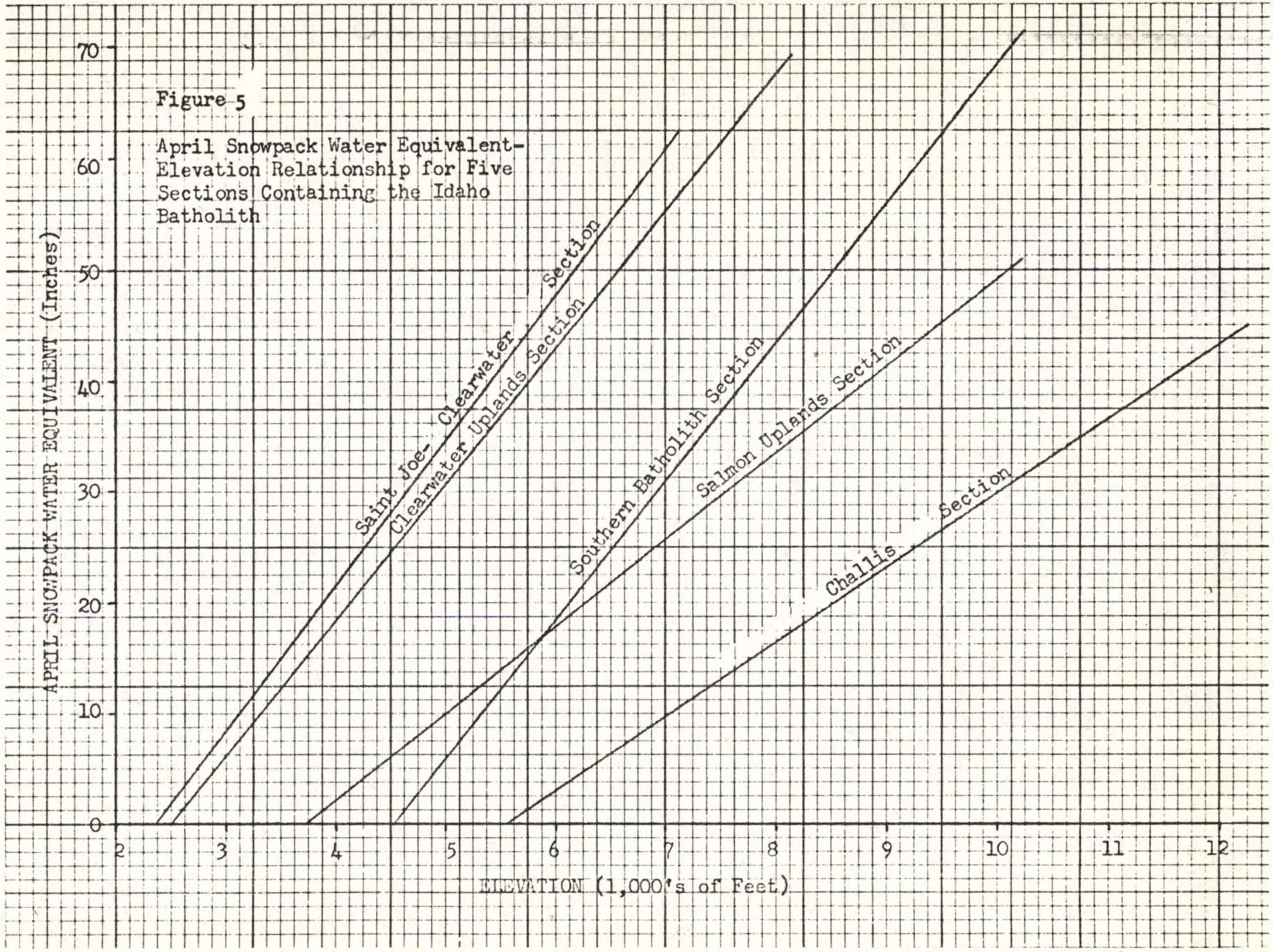


Figure 5

April Snowpack Water Equivalent-Elevation Relationship for Five Sections Containing the Idaho Batholith

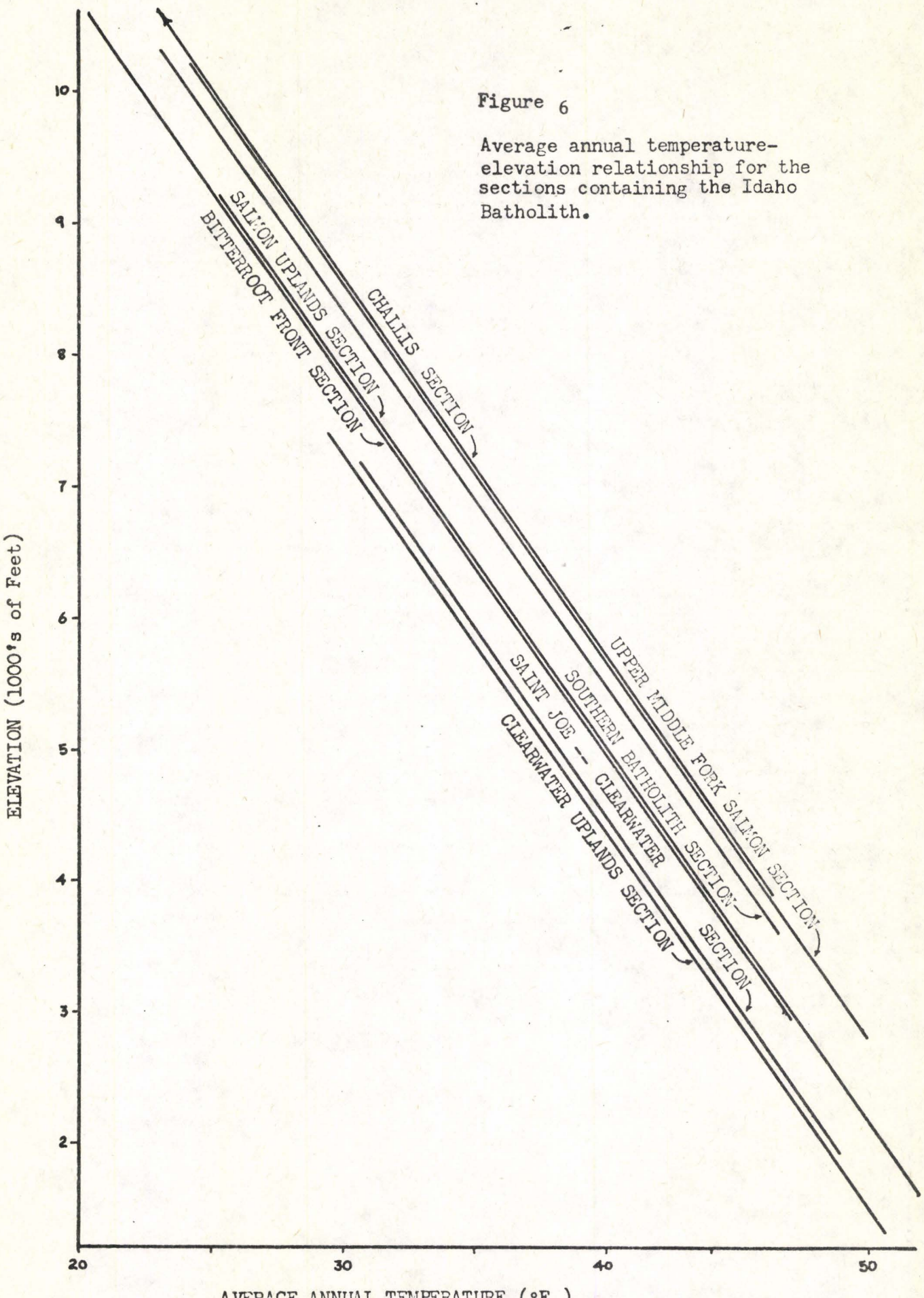


Figure 6

Average annual temperature-elevation relationship for the sections containing the Idaho Batholith.

Table 9

STREAMFLOW DATA FOR STREAMS DRAINING IDAHO BATHOLITH LANDS - ALL FLOW DATA ON A WATER YEAR BASIS

(Source - U.S. Geological Survey Records - Stations selected are those with drainage areas entirely within the Batholith
In a few cases a small fraction of the area is not batholith, e.g., Lochsa nr. Lowell 5%.)

Station number Old	Station number Present	Location	Stream gage site location	Years of record	Low flow Acre feet	Low flow Year	Low flow % of avg.[1]	High flow Acre feet	High flow Year	High flow % of avg.	Average flow acre feet All years record	Average flow acre feet 15-year base period 1947-62	Area above station sq. mi.	Average flow inches All years record	Average flow inches 15-year base period 1947-62	Diversions & Regulations
		BOISE RIVER BASIN														
331	—	M.Fk. Boise, above M.Fk.		4	1947-50	423,400	1949	—	513,900	1950	—	461,600	--	382	22.67	—	NONE
332	13-1850	M.Fk. Boise, above Arrowrock		55	1911-66	416,000	1924	49	1,436,000	1965	168	854,810	940,350	830	19.31	21.19	NONE
334	13-1860	S.Fk. Boise, above Anderson Ranch	Separate	21	1945-66	309,800	1961	54	990,900	1965	174	569,680	567,980	635	13.08	16.73	Small Ranch irrigation
		PAYETTE RIVER BASIN														
410	13-2350	S.Fk. Payette at Lowman		25	1941-66	430,900	1944	68	899,000	1965	143	629,116	633,900	456	25.87	26.00	Small irrigation diversion have return flow
414	13-2375	S.Fk. Payette, at Gardem Valley		39	1921-60	503,000	1931	53	1,489,000	1956	157	946,230	—	779	22.78	—	Small diversions; partly controlled by Deadwood Res. since 1920
415	13-2380	S.Fk. Payette, above Banks		45	1921-66	650,000	1924	51	2,093,000	1965	163	1,284,200	1,430,090	1200	20.06	22.29	"
416	13-2390	M.Fk. Payette at McCall		55	1909-66[2]	124,000	1931	48	371,000	1921	142	260,525	279,640	144	33.92	36.31	Partly regulated by gates at lake outlet
423	13-2425	Lake Fk., Payette R. near McCall		26	1940-66	49,030	1944	54	129,100	1943	141	91,560	91,280	64	26.82	26.67	Flow regulated by Lake Fk. Res. since 1926. Div. by Lake canal
430	13-2460	M.Fk. Payette, above Banks		19	1948-66	701,800	1955	72	1,349,000	1965	138	974,620	957,010	933	19.59	19.18	Flow reg. by Cascade Res. Many irrigation diversions
		SALMON RIVER BASIN														
519	13-2955	Salmon R. at Stanley	Separate	35	1925-60	296,000	1931	62	738,900	1956	154	480,700	—	501	18.00	—	Some irrigation diversion
524	—	E.Fk. Salmon near Clayton	Separate	11	1929-39	88,570	1934	62	273,900	1938	191	143,620	—	497	5.4	—	Several small diversions
545	13-3085	N.Fk. Salmon, near Cape Horn	Separate	38	1928-66	97,600	1931	57	270,800	1943	158	171,540	186,190	138	23.31	25.23	NONE
546	13-3090	Bear Valley Crk. near Cape Horn	Separate	32	1928-60	108,000	1931	51	332,800	1943	159	210,000	—	180	21.87	—	NONE
554	13-3130	Johnson Crk. at Yellow Pine	Separate	38	1928-66	120,000	1931	48	395,800	1965	159	249,020	275,300	213	21.91	24.17	One small diversion
556	—	S.Fk. Salmon at S.Fk. Guard Sta.	Separate	11	1931-42	812,100	1937	70	1,549,000	1938	134	1,160,000	—	1160	18.76	—	NONE
		SELWAY RIVER BASIN														
592	—	Selway 20 mi. above Lowell		5	1945-49	1,762,000	1945	—	2,896,000	1947	—	2,440,600	—	1550	29.54	—	Small
593	13-3365	Selway 7 mi. above Lowell		37	1929-66	1,617,000	1941	60	3,566,000	1947	133	2,682,460	2,995,650	1910	26.31	29.33	Several small diversions
		LOCHSA RIVER BASIN														
594	13-3370	Lochsa near Lowell	Separate	39	1911-12 1930-66	1,145,000	1941	56	2,762,000	1959	135	2,052,360	2,292,200	1180	32.60	36.33	NONE
		KOOTENAI RIVER BASIN														
—	12-3110	Deep Cr. at Moravia	Separate	38	1928-67	49,300	1931	47	166,400	1956	160	104,300	123,880	133	14.66	17.42	Small diversion slight regulation
—	12-3215	Boundary Cr. near Porthill	Separate	38	1931-67	60,240	1944	43	208,100	1956	150	139,000	157,210	97	26.79	30.31	NONE
		PEND OREILLE RIVER BASIN														
—	12-3923	Pack River near Colburn	Separate	8	1958-67	196,600	1966	—	281,200	1961	—	235,300	—	124	35.48	—	NONE

1/ Percent maximum and minimum flows given only for stations with 10 or more years of record.
2/ Two years data missing.

A DESCRIPTION OF THE AREA AT THE SECTION LEVEL OF GENERALIZATION

Section I - The Southern Batholith Section

The Southern Batholith Section encompasses approximately 9,400 square miles lying roughly between 43° and 45° north latitude and 114° 15' and 116° 15' west longitude. It is primarily drained to the north by the South and Middle Forks of the Salmon River and to the south by the Payette and Boise River drainages.

Elevations range from about 3,000 feet to over 10,000 feet with a median elevation of about 6,500 feet. Although it contains several low relief basins (Long Valley, Stanley, Idaho City, Warm Lake, and Deadwood) and some rolling uplands (Landmark, Bear Valley), most of the area is mountains of moderately high (1,000-3,000 feet) to high (3,000-5,000 feet) relief.

Twenty-five subsections or physiographic areas have been identified (Table 10). Each is distinctly different from those immediately adjacent. However, some widely separated subsections may share similar characteristics.

Almost the entire section is underlain by rocks of the Idaho Batholith with a few areas of overlying patches of Challis Volcanic (mainly along its northeastern boundary and in the Profile-Monumental Subsection), a few areas of tertiary and quaternary sediments, and even some patches of basalts. Dike swarms of intermediate volcanic character are common in portions of this section. Schmidt (1964) distinguished a sequence of granitic rocks from the western border eastward to the center of the Batholith as follows: A migmatite border zone; a quartz diorite gneiss zone; a leucocratic quartz diorite zone; a granodiorite zone; and finally, a quartz monzonite zone.

Soils from granitic parent materials (more than 80 percent of the section) are dominantly moderately coarse to coarse textured throughout their profiles. Soils are mostly stony in the Strongly Glaciated, Frost Churned, and some Depositional Landtype Associations. Shallow soils are not the rule, but are present on extremely steep slopes, ridges, and headlands. Soils from other than granitic parent materials are mostly loamy in texture and stony.

This area is the southeastern limit of major maritime influence in central Idaho. The combination of a marginal maritime influence superimposed on a dominantly droughty, granitic parent material of low fertility has created a vegetal mosaic peculiar to this section.

The lowest elevations, and especially southerly aspects, support a mosaic of mountain shrub and steppe vegetative communities. Subalpine big sagebrush/bluebunch wheatgrass and subalpine big sagebrush/Idaho fescue are the most common steppe communities in the southern portions of this area, while bluebunch wheatgrass/Sandberg's bluegrass and bluebunch wheatgrass/Idaho fescue become more common further north. A

Table 10

Twenty-five subsections or physiographic areas have been identified in the Southern Batholith Section.

Map Symbol	Subsection Name	Some Physiographic Characteristics: Range in Elevation	Dominant Local Relief	Median Elevation
1.	Smiths Prairie Lowlands Subsection	3400-7400	1000-1700	5000
1a.	Danskin Mountain Subsection	4000-6000	1000-1700	4700
2.	Trinity - Soldier Mountain Foothills Subsection	4200-10100	1500-2000	6000
3.	(SW 1/3) Middle Fork Boise River Canyon and Streamcut Lands Subsection	3000-6300	800-1800	4500
3.	(NE 2/3) Middle Fork Boise River Canyon and Streamcut Lands Subsection	3500-9700	1500-2500	5500
4.	South Fork Boise River Uplands Subsection	4500-9700	1000-1600	5500
5.	Upper South Fork Boise River Streamcut Lands Subsection	5000-9000	1000-2000	6800
6.	Smoky Mountain Trough Lands Subsection	5800-10100	1800-2600	8000
7.	Montezuma Fault Lands Subsection	5100-9500	1000-2000	6800
8.	Sawtooth Foothills Subsection	4900-9400	1500-2500	7000
9.	Lowman Uplands Subsection	4800-8800	800-1400	6500
10.	(S 1/2) Boise Basin Subsection	3200-5100	1000-1800	4700
10.	(N 1/2) Boise Basin Subsection	3900-6500	800-1200	3800
10a.	Boise Ridge-Payette Canyon Lands Subsection	2700-7250	1000-2500	5200

Map Symbol	Subsection Name	Some Physiographic Characteristics: Range in Elevation	Dominant Local Relief	Median Elevation
11.	Middle Fork Payette Canyon and Streamcut Lands Subsection	3100-8200	1000-2500	5500
12.	Sawtooth Mountains Subsection	5100-10800	2000-4000	8300
13.	Stanley Basin Subsection	6200-8000	100/500-1000	7000
14.	Stanley Uplands Subsection	6100-9300	1000-1600	8000
15.	Bear Valley-Landmark Basin and Uplands Subsection	5100-9000	100/800-1500	7000
16.	Middle Fork Payette Canyon and Streamcut Lands Subsection	3200-7600	1000-3000	5800
17.	Long Valley Subsection	4700-7000	100	5200
18.	Long Valley Foothills Subsection	4900-8500	100/500-1000	6000
19.	Upper South Fork Salmon Subsection	5000-8700	100/1000-1500	6800
20.	Fitsum Peak Glaciated Lands Subsection	5000-9300	2000-3000	7000
21.	Upper South Fork Salmon River Canyon Land Subsection	3700-8900	2000-3000	6000
22.	Upper Middle Fork Salmon Streamcut and Canyonlands Subsection	4200-10300	2500-3000	7500
23.	Profile-Monumental Subsection	3800-9450	2000-3500	7000

bluebunch wheatgrass/oniongrass community occurs primarily on the unstable slopes near the Sawtooth Mountains. Bittercherry, chokecherry, bitterbrush, mountain snowberry, and subalpine big sagebrush occur in various combinations to form the mountain shrub zone.

In the river canyons where lower timberline extends to lower elevations, ponderosa pine usually forms a minor climax zone between the steppe communities and Douglas fir forests. Here ponderosa pine/bitterbrush and ponderosa pine/bluebunch wheatgrass are the most common ponderosa pine habitat types. Lesser amounts of ponderosa pine/common snowberry and ponderosa pine/Idaho fescue occur with special site conditions. Above the river canyons where lower timberline occurs at higher elevations, ponderosa pine is often absent as a climax species.

Douglas fir forests in this section often resemble those further north but usually lack the total floristic composition common to a stronger maritime influence. As a result, Douglas fir/elksedge and Douglas fir/spiraea habitat types often dominate much of this area in a pattern similar to their more mesic counterparts, Douglas fir/pinegrass and Douglas fir/common snowberry. The two latter habitat types are indicative of climatic conditions to the north and occur in this section primarily where soil and topographic conditions ameliorate the site. Toward the northern portion of this section, Douglas fir/pinegrass gradually increases in acreage at the expense of Douglas fir/elksedge but a similar response of common snowberry is only weakly apparent. Douglas fir/ninebark, the most common habitat type in the Douglas fir zone, ranges throughout this area but its frequency of occurrence decreases from north to south.

Grand fir is poorly represented in this section. It forms a minor zone in the northwestern portion where it occurs most often in the grand fir/tall huckleberry habitat type. Western larch barely enters this section in about the same area.

Subalpine fir ranges widely in this section and occupies the greatest diversity of habitat types. Drier slopes and ridges most often support subalpine fir/elksedge in the southern regions with subalpine fir/pinegrass and subalpine fir/grouse whortleberry becoming more common with increasing latitude or moisture. More protected aspects commonly support subalpine fir/tall huckleberry. Only the extreme northerly portions of this section provide the beargrass, menziesia, and queencup understories indicative of stronger maritime conditions.

This section contains several large glaciated valleys with broad, gentle valley bottoms. Lodgepole pine commonly dominates much of the valley floor and forms nearly pure stands that persist for several generations. Where soil moisture is adequate, subalpine fir and Engelmann spruce slowly invade to denote the subalpine fir/dwarf huckleberry habitat type. On drier sites, the dwarf huckleberry, spruce and fir cannot invade, leaving only a lodgepole pine/Idaho fescue potential.

This section has a wide variation in annual precipitation. An average of less than 15 inches is received within the southern portions. High

mountain peak areas receive over 50 to 60 inches. The average annual precipitation for the entire section is about 32 inches. Less frequent cyclonic storm activity and more mountainous barriers to storm movement are primarily responsible for the comparatively low precipitation received in the southern portion.

The section is characterized by wet winters and dry summers. The wet season generally runs from November through March. Precipitation during this period is dominantly by cyclonic storms from the Pacific Ocean. Precipitation stations within the section average monthly totals of less than 0.5 inches during July and August which are the driest months of the year.

April 1 snow surveys find the highest winter water content, with the snowpack containing approximately 55 to 60 percent of the total annual precipitation. Slopes are typically bare below an elevation of 4,500 feet during the winter.

The average annual maximum, mean, and minimum air temperatures for this section at median elevation are about 46°F., 36°F., and 22°F., respectively. The maximum-minimum variation is 24°F. The main reason for the relatively wide variation between average annual maximum and minimum temperatures is the reduced influence of Pacific Ocean air masses as compared to more northern portions of the State. The elevational relief within the section is approximately 7,000 feet. This range in elevation can account for about a 23°F temperature difference between the lowest and highest areas of the section at any given time.

The longest growing season of about 160 days is within the low elevation valleys of the Boise River. Midelevation valleys have a growing season of 50 to 70 days. Stanley Basin country has a growing season of less than 10 days. The high elevation topography between the Boise-Payette Rivers and the Salmon River has a growing season of less than 20 to 30 days.

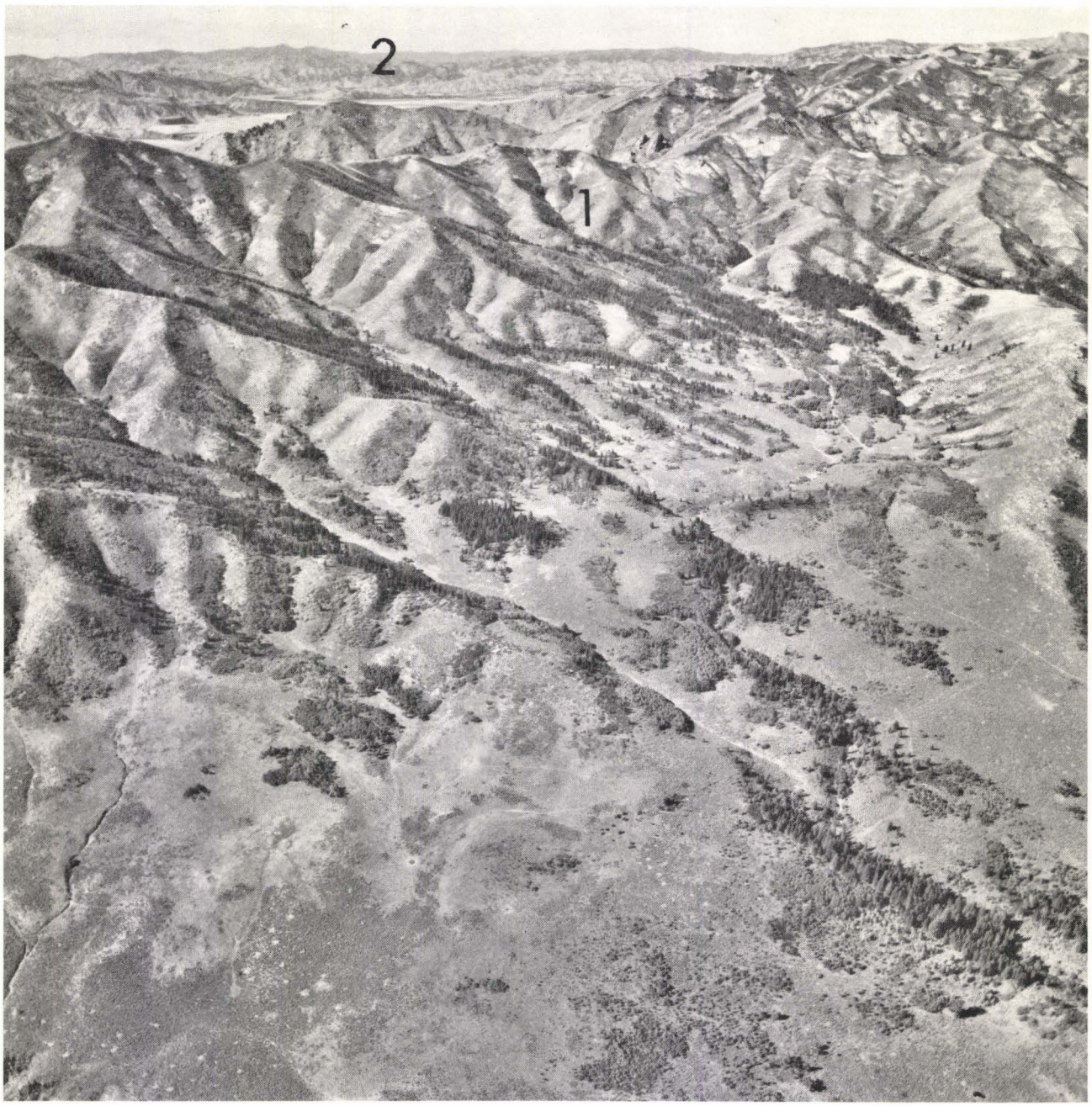
Evapotranspiration utilizes 17.13 area-inches of the average annual precipitation of 32.06 area-inches. This represents 8,833,000 acre-feet of water or 53.7 percent of the average annual precipitation.

This section produces almost 607,106,000 acre-feet or 13.5 inches of water annually.

Historically, the concern for sedimentation centered on lands within this section. It contains the central core of the Idaho Batholith rocks with weathering characteristics which lead to high sedimentation rates. This area also has large contiguous areas of Fluvial Landtype Associations which have been partially or strongly rejuvenated by block faulting and uplift. These characteristics, plus the early and intensive use of

these lands, produced large amounts of sediment in the major river systems.

The chief tools to reduce sediment production are sound planning processes which will establish objectives and coordination of requirements on an area-of-land basis...a matter of prevention rather than rehabilitation.



Smiths Prairie and Foothills Subsection (1); Trinity-Soldier Mountain Foothills Subsection (2) in far background.

Subsection 1 - Smiths Prairie Lowlands Subsection

The Smiths Prairie Lowlands Subsection is about 220,000 acres in extent. The area ranges in elevation from about 3,500 to 7,500 feet with a median elevation of about 5,000 feet. Dominant local relief ranges from 1,000 to 1,700 feet. The area contains most of the volcanic flow lands of the South Fork of the Boise River. These flows are mainly of two types: (1) the Snake River Basalt flows of the Quaternary Period, and (2) the older, more silicic (felsitic) flows of the Pliocene Epoch. Granitics visibly underlie some of the flows and are the bedrock of most of the rest of the subsection. Smiths Prairie itself consists mainly of a basalt plain dissected by the river entrenched basalt escarpment; some basalt rockland is associated. The silic volcanic flow lands are generally steeper and more highly dissected, due in part to having been exposed longer to erosional processes and in part due to having been uplifted in places. The lands underlain by the granitics (mainly "Atlanta" granodiorite) are extremely variable, ranging from oversteepened canyon and to maturely dissected mountain slope land with low relief. Rock weathering classes 4, 5, and 6 are dominant in the granitics.

Soils on the area are variable depending on the landtype association in which they occur and the parent materials in which they are developed, with sandy to coarse loamy (skeletal and nonskeletal) soils on fluvial lands with granitic parent materials to skeletal sandy clay loams on silic volcanic lands. Xeric (dry) families are dominant to common in both situations. On the basalt plain soils are xeric, shallow to deep with clay loam textures dominant.

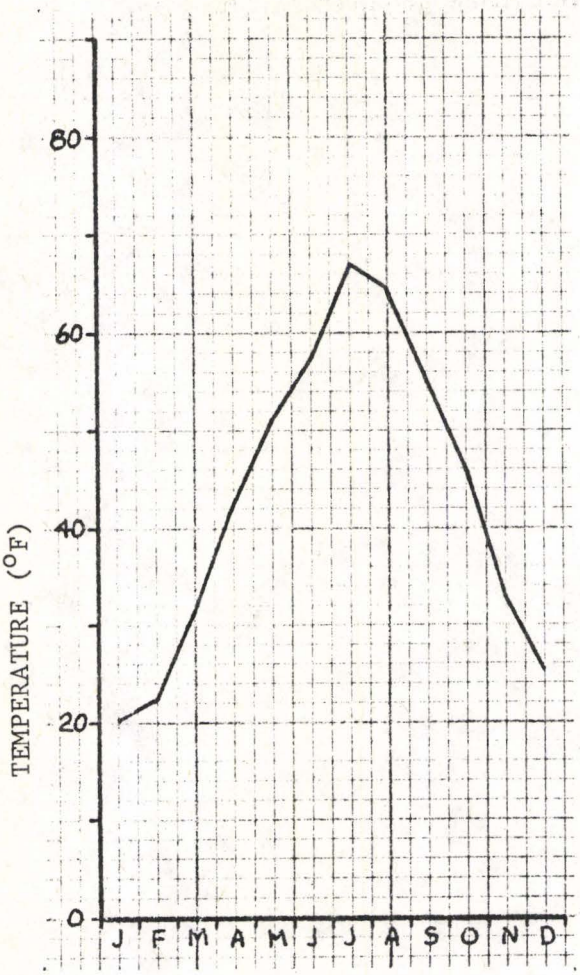
Subalpine big sagebrush dominates the bulk of this area with bluebunch wheatgrass and Idaho fescue as the understory grasses on south and north slopes respectively. In the more mesic conditions of the river canyon, Douglas fir/mountain snowberry (whortleleaf snowberry) and Douglas fir/ninebark occur on the warmer and cooler sites respectively. On some of the coarser soils, especially in the Smiths Prairie region, bitterbrush/subalpine big sagebrush and some ponderosa pine/bitterbrush occur. In the same area, small amounts of ponderosa pine/bluebunch wheatgrass, ponderosa pine/Idaho fescue, and Douglas fir/spiraea occur on appropriate sites.

The climatic characteristics are strongly reflected by the vegetation and soils in the area. Less than 30 percent of the area is timbered and xeric soils dominate the southern slopes. Annual precipitation in the area ranges from 15-25 inches but is mostly less than 20 inches. Runoff from the area is only about 5 inches per year.

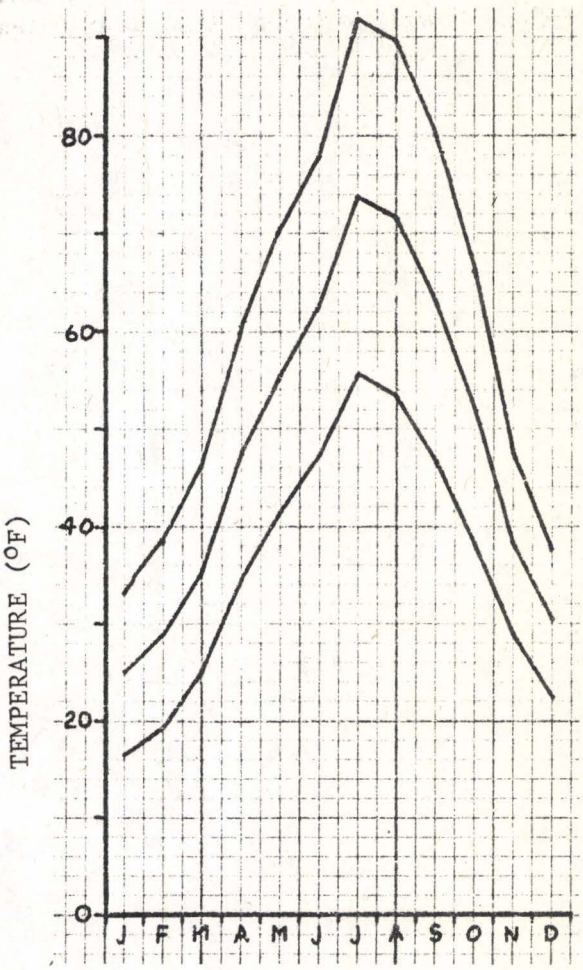
The following shows the range in precipitation that can be expected for 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.4-2.0
10	24	2.0-2.6
25	24	2.4-3.0
10	6	1.2-1.5
25	6	1.5-1.8

The following figures give the mean annual, maximum, and minimal temperatures for the two weather stations in the area (Prairie and Anderson Ranch). Summers are long and dry and the winters cold.



PRAIRIE
ELEV. = 4670
YEARS = 12
-43.1-



ANDERSON DAM
ELEV. = 3882
YEARS = 19
61.6-48.7-35.9

The chief management problems associated with lands in this subsection are associated with the long, dry summers and the cold winter temperatures. On moderately coarse textured soils, these limitations make management for any vegetative cover extremely difficult. Surface erosion on finer textured soils with less than adequate protective vegetation cover has been a problem.

Subsection 1a - Danskin Mountain Subsection

The Danskin Mountain Subsection is a small (about 45,000 acres) area bounded on the north by the Middle Fork Boise River Canyon and Streamcut Lands Subsection, Smiths Prairie and foothills to the east and Boise-King Hill Section of the Intermontane Province to the southwest. This area is drained mainly by Willow Creek and ranges in elevation from about 4,000 to 6,000 feet. About 10 percent of the area is below 4,000 feet, 80 percent between 4,000 and 5,000 feet, and about 10 percent above 5,000 feet. The area consists mainly of moderately steep to steep, well dissected granitic fluvial lands with minor amounts of depositional lands and canyon lands on Willow Creek and a small amount of silic volcanic lands.

Bedrock is dominantly granitic in character (mainly "Atlanta" type granodiorite); soils are generally moderately deep and range from dominantly coarse loamy to sandy texture (skeletal and nonskeletal). These soils exhibit little or no profile development. About one-half of the soils in the area are xeric.

This area is dominated by subalpine big sagebrush with various grasses in the understory that differ in species with change in aspect and soil depth. Steep northerly aspects with more moisture often support patches of Douglas fir/mountain snowberry (whortleleaf snowberry), and occasionally at lower elevations Douglas fir/ninebark.

Average annual precipitation is about 12-14 inches in the area; runoff ranges from about 1-4 inches annually.

Steep, highly erodible slopes and maintaining adequate vegetation in a droughty cold environment are the chief management problems.

The following shows the range in precipitation that can be expected for 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.2-1.6
10	24	1.8-2.0
25	24	2.2-2.4
10	6	1.1-1.2
25	6	1.2-1.3

Trinity-Soldier Mountain Subsection (2).

Subsection 2 - Trinity-Soldier Mountain Foothills Subsection

The Trinity-Soldier Mountain Foothills Subsection comprises about 200,000 acres along the south facing front of the Southern Batholith Section. It represents the first major uplifted ridge system of the Northern Rocky Mountain Province, evidently in response to the large Snake River Plain downwarp. The area ranges in elevation from 4,200 to over 10,000 feet with a median elevation of about 6,000 feet. Dominant local relief ranges from 1,500 to 2,000 feet.

The Trinity portion is drained chiefly by Smith Creek, Deer Creek, and Fall Creek and ranges in elevation from 5,000 to 8,500 feet. Bedrock is dominantly granitic which is most moderately well to well weathered (weathering classes 4 to 5).

The upper slopes (7,500-8,500 feet) are frost churned (cryic) slopes, some of which are thin soiled as a result of their rejuvenated character, have gradients about 50 to 60 percent, and are generally sparsely vegetated with trees but with moderate brush cover. Other frost churned (cryic) slopes, particularly those with easterly aspects, are densely vegetated with mainly subalpine fir/elksedge habitat type.

Soils range from moderately deep to deep loamy skeletal mixed soils having generally moderately low productive capacities for range and timber. Chief limitations are short growing seasons, low water holding capacity, and moderately low fertility.

Some of these Frost Churned (cryic) Uplands are actively eroding due to past grazing use. The rest of the Trinity portion is comprised of moderately to strongly dissected fluvial lands with typical moderately coarse to coarse textured moderately deep soils. Brush dominates the general appearance of these slopes due to past fires with timber restricted to the north and east slopes at lower elevations and on all slopes at upper elevations.

The Soldier Mountain portion of this subsection extends eastward from Anderson Ranch Reservoir to the divide between Soldier Creek and Deer Creek and southward from Soldier Mountain Ridge to the Snake River Plains Section of the Intermontane Province and the Smiths Prairie lowlands. The unit is drained to the south by Big Deer Creek, Little Creek, Coral Creek, Three Mile Creek, and Soldier Creek. Bedrock is dominantly granitic with numerous dikes of darker igneous intrusions. Challis Volcanics occur on the western extremity of the unit. Bedrock in the area is dominantly moderately well fractured moderately well weathered.

Vegetation is widely variable, with many brush fields formerly occupied by conifer habitat types and many nontimbered slopes on warmer aspects

which will not support trees. The vegetation on the nontimbered south aspects is dominantly a mountain snowberry (whortleleaf snowberry), subalpine big sagebrush community. Most of the adjacent northerly aspects support a prunus/mountain snowberry (whortleleaf snowberry), or Douglas fir/mountain snowberry association. Timbered slopes at intermediate elevations are dominantly Douglas fir/spiraea and Douglas fir/ninebark on south and north slopes respectively. Douglas fir/elksedge also occurs here and merges with subalpine fir/elksedge on the ridges. Small amounts of Douglas fir/mountain maple and subalpine fir/mountain maple may be found on northerly aspects having deep moist soils.

Precipitation in the area ranges dominantly from 20-25 inches per year with extreme ranges of 15-40 inches. Runoff ranges from 5-20 inches per year.

The following shows the range in precipitation that can be expected for 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hour)	Range in Precipitation (Inches)
2	24	1.6-2.2
10	24	2.2-3.0
25	24	2.8-3.6
10	6	1.4-1.7
25	6	1.6-2.0

Chief management problems in the area are associated with maintaining adequate cover for the erodible soils in the area. Forest regeneration problems on the drier habitat types are still a problem, especially Douglas fir.

Looking north across Middle Fork Boise River Canyon Streamcut Lands Subsection (3) into Boise Basin Subsection (10).

Subsection 3 - Middle Fork Boise Canyon and Streamcut Lands Subsection

The Middle Fork Boise Canyon and Streamcut Lands Subsection occupies about 400,000 acres in the middle portion of the Middle and North Forks of the Boise River drainages and contains the Lucky Peak and Arrow Rock Reservoirs. It is bounded on the east by the Sawtooth Foothills uplift and on the north by the Lowman uplift from which the area gained structural control of its relatively steep stream gradient. This structural control, plus the high volume runoff energy sources from the deep snow peaks, Sawtooth Foothills, and the Sawtooth's subsections determined the deeply stream entrenched and canyon-like characteristics of the subsection. Over 70 percent of the area lies between 4,000 and 8,000 feet. Steel Mountain is 9,740 feet high and Trinity Ridge is about 7,500 feet. The median elevation for the SW 1/3 of the area is about 4,500 feet where dominant local relief ranges from 800 to 1,800 feet. The median elevation for the NE 2/3 of the area is about 5,500 feet where the dominant relief ranges from 1,500 to 2,500 feet.

The only glaciated lands are in the moderately expressed cirques and troughs at the head of Roaring River on Trinity Mountain and at the heads of Hot Creek and Steel Creek on Steel Mountain. The frost churned (cryic) landscapes are limited to Trinity Ridge, Sunset Mountain Ridge to the west of Crooked River, and the ridge system radiating from Thorn Creek Butte. Most of the rest of the area is steep Strongly Dissected Fluvial Lands with minor amounts of Moderately Dissected Fluvial and Faulted Bench Lands. Oversteepened Canyon Lands are restricted to the truncated faces immediately adjacent to the major streams. Depositional Lands in the area are restricted to very narrow bands along the streams and rivers.

Except for intrusive dikes or darker igneous rocks and the common occurrence of rhyolitic outcrops, most of the bedrock is granitic. The character (degree of weathering and fracturing) of the bedrock has a great deal to do with the resistance that slopes have to management activities like road building. Even steep slopes underlain by well fractured granitic rock with weathering classes of 3 or less yield road building materials of fair gradation qualities. With proper location and design features, roads can often be built safely across some of these steep slopes. Often, however, on south facing slopes at intermediate elevation bedrock is more massive and in weathering class 4 or even 5, making roads a source of high sediment production.

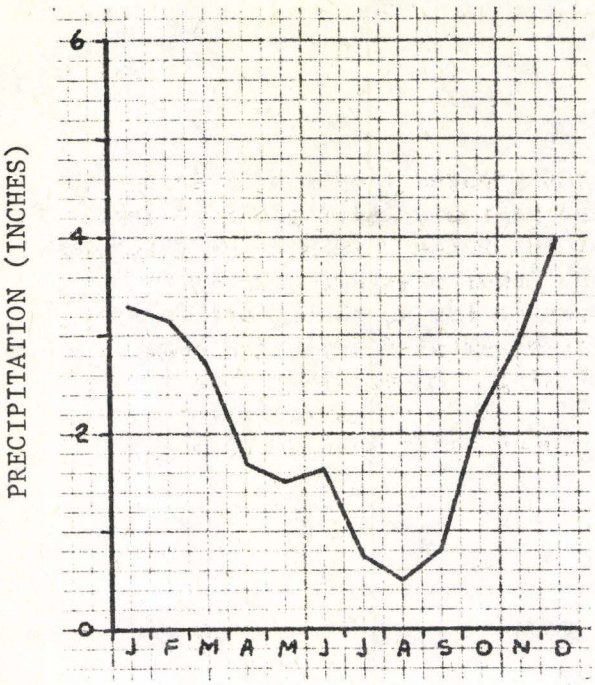
Soils range dominantly from moderately deep to deep and moderately coarse textured with many having considerable amounts of coarse fragments (skeletal). The soils associated with high runoff areas are dominantly shallow and coarse textured (on steep rocky headlands and oversteepened canyon lands). When these occur on south slopes, the soils are xeric as well.

Vegetation as would be expected has a wide variability with communities representing subalpine to high desert types well represented. Bitterbrush/cherry and bitterbrush/subalpine big sagebrush communities occur over much of the lower elevations with xeric soils in this unit. Further upstream along the river canyon, ponderosa pine/bluebunch wheatgrass, ponderosa pine/Idaho fescue, and ponderosa pine/bitterbrush occur in varying amounts below the Douglas fir zone. Douglas fir/spiraea on southerly aspects and Douglas fir/ninebark on northerly aspects are the two most common habitat types at midelevations. The upper elevations support mostly Douglas fir or subalpine fir/elksedge depending on position of the site. Moist, northerly aspects support mostly subalpine fir/tall huckleberry with small pockets of subalpine fir/grouse whortleberry on special sites in the same area.

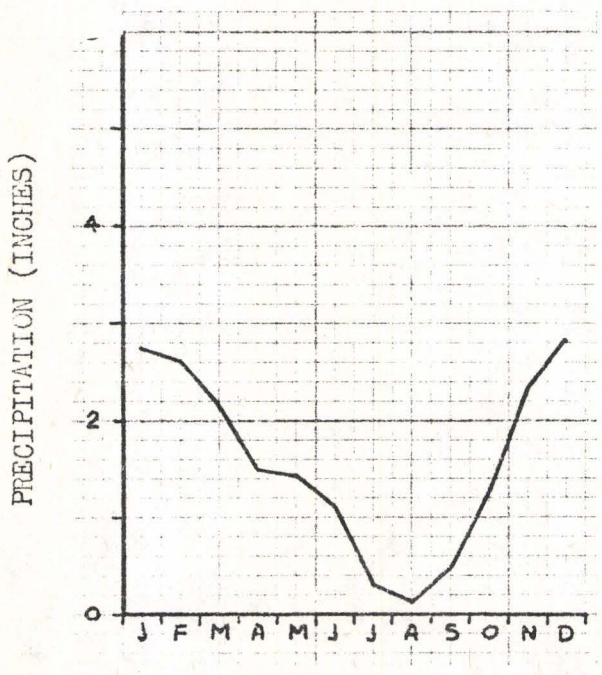
Average annual precipitation ranges from 15 inches at the lower end of the area to 40-50 inches in the Steel Mountain-Trinity Ridge and runoff ranges from 5-10 inches at the lower end of the unit to 15-30 inches on the upper end of the area.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.2-2.4
10	24	2.0-3.4
25	24	2.6-4.0
10	6	1.1-1.8
25	6	1.3-2.2

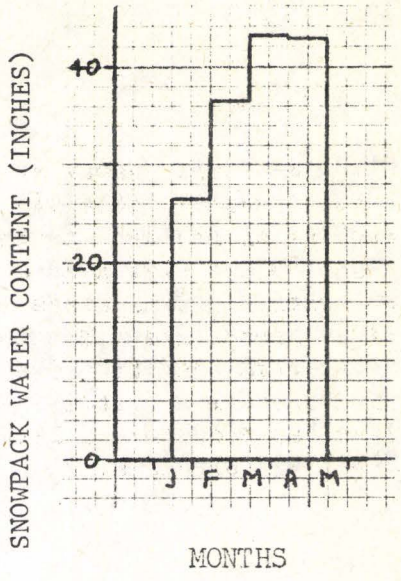
The following figures show snowpack duration, precipitation distribution, and temperature data for several key stations within the area.



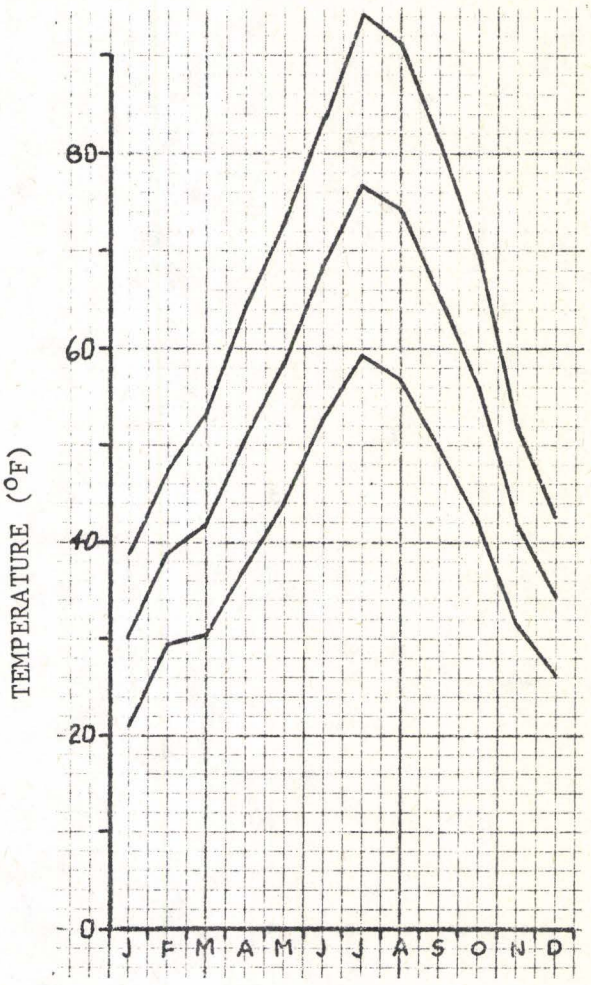
ATLANTA 1E
ELEV. = 6000
YEARS = 17
A.A.P. = 25.17



ARROWROCK DAM
ELEV. = 3239
YEARS = 30
A.A.P. = 18.82



TRINITY MOUNTAIN
ELEV. = 7780



BOISE LUCKY PEAK DAM
ELEV. = 2840
YEARS = 9*
66.0-53.1-40.2

High intensity summer storms falling on nontimbered slopes with less than adequate vegetative cover have in the past and still generate large amounts of sediment to the Middle Fork of the Boise. Such occurrences constitute a real hazard especially in the lower one-third of the subsection. Some areas in the upper slopes in the southern portion are flood source areas due mainly to thin coarse textured soils and poor vegetative condition due to past heavy grazing. Development of a transportation system to safely utilize the timber resource in the area is a key problem. Grazing and big game winter range management are other key problems.

South Fork Boise River Uplands Subsection (4).

Subsection 4 - South Fork Boise River Uplands Subsection

The South Fork Boise River Uplands Subsection is a 125,000-acre area which appears to be a dissected basin surrounded by a high frost churned (cryic) ridge system from Trinity Ridge northeast to Steel Mountain and east to Gunsight Peak. It is drained mainly by a dendritic pattern of streams: Trinity Creek, Feather River, Shake Creek, and Willow Creek which drain directly into the South Fork of the Boise River. It ranges in elevation from about 4,500 feet at Pine to about 9,700 feet at Steel Mountain with a median elevation of about 5,500 feet. Dominant local relief ranges from about 1,000 to 1,600 feet. Only a small portion of the area shows the effects of much alpine glaciation: the head of Trinity Creek (containing Trinity lakes), Steel Mountain, and Willow Creek. The eastern boundary of the subsection follows the county line between Elmore and Camas Counties. This line crosses the river about where the river gradient steepens markedly in a narrow canyon. The subsection to the west (Upper Boise River Streamcut Lands) has apparently been uplifted giving different operational base levels to these adjacent subsections.

There are wide river deposits adjacent to the Boise River along all but a few miles of the 20 to 25 miles of the river as it passes through the subsection. These deposits range from one quarter to almost a mile in width. Some of these deposits were dredged for gold in the recent past.

The fluvial lands of this dissected basin, particularly in the central and west portions of the area, are characterized by broad rolling upland ridges (which appear to represent remnants of a former basin floor) interspersed by steep sloped drainageways. The steepest slopes are adjacent to the main drainage in the form of oversteepened canyon lands.

Bedrock in the area is almost entirely granitic. It is characteristically in weathering classes 5 and 6 in the more subdued basin relief and more competent and highly fractured along the margins and in the entrenched canyons. Intrusive dikes are common.

Soils are dominantly moderately deep to deep, moderately coarse to coarse textured granitic soils. Shallow soils occupy less than 15 percent of the area. Some xeric soils occur on south slopes at lower elevations.

Vegetation is highly variable but may be described as follows: Small amounts of sagebrush/grass and mountain snowberry/subalpine big sagebrush communities occur on the driest slopes and ridges in this unit. Ponderosa pine and Douglas fir/bluebunch wheatgrass occupy somewhat greater areas on the drier south aspects with Douglas fir/mountain snowberry on the ridges.

Douglas fir/spiraea and Douglas fir/ninebark occupy much of the area on south and north aspects respectively at intermediate elevations with Douglas fir/elksedge and subalpine fir/spiraea at slightly higher elevations. Douglas fir and subalpine fir/mountain maple occur sporadically throughout this area on northerly aspects with deep moist soils. Small amounts of whitebark pine/subalpine fir can be found on the highest ridges in the area.

Average annual precipitation for the area ranges from 20 to over 50 inches. The area probably averages a good 12 inches runoff overall.

The following shows the range in precipitation that can be expected for 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.6-2.2
10	24	2.4-2.8
25	24	2.8-3.4
10	6	1.4-1.6
25	6	1.6-1.8

The chief management problems in the area are associated with road building and timber harvesting activities on the lands underlain by the highly weathered granitic bedrock. Range management problems are associated with managing granitic soils which still bear the marks of past heavy use.

Upper South Fork Boise River Streamcut Lands
Subsection (5).

Subsection 5 - Upper Boise River Streamcut Lands Subsection

The Upper Boise River Streamcut Lands Subsection is about 110,000 acres in the strongly entrenched, essentially unglaciated easternmost portion of the South Fork of the Boise River. About 80 percent of the area lies between 5,000 and 8,000 feet; about 15 percent lies between 8,000 and 9,000 feet. Elevations range from about 5,000 to 9,000 with a median elevation of about 6,800 feet. Dominant local relief ranges from 1,000 to 2,000 feet.

The unit appears to be a rejuvenated basin. The spur ridge systems appear to be the remnants of former basin floor. The deeply entrenched character of the valley and ridge system in the unit may be the result of differential uplifting of the South Fork of Boise drainage associated with Smokey Mountain and Sawtooth orogeny resulting in an acceleration of erosional processes. The nickpoint of this differential uplift appears to be located roughly along the spur ridges near the Elmore-Camas County line.

Bedrock in the area is chiefly granitic except in the eastern portion of Little Smokey drainage which is formed in Challis Volcanics and to a lesser extent Wood River sedimentary rocks. Weathering class ranges dominantly from 3-5 with the more competent rock in the entrenched drainageways.

Landtypes in the area are chiefly moderately to well dissected fluvial mountain slopes, some of which are timbered and some sagegrass and mountain brush covered. Soils are dominantly moderately deep but deep and shallow soils are common. Soil textures range dominantly from sandy loam to loamy sands on granitic materials and sandy loams to loams on other parent materials. Xeric soils are restricted to the south slopes at lower elevations.

The heads of Deadwood and Boardman Creeks near Iron Mountain (elevation 9,705) have been weakly glaciated. Slopes near the main drainage have been geologically oversteepened. Depositional lands are restricted to narrow bands adjacent to the river and its major tributaries.

Douglas fir/elksedge typify much of forest habitat types on this area. Where there is slightly more moisture or finer textured soils, Douglas fir/pinegrass replaces the elksedge. With less moisture, Douglas fir/bluebunch wheatgrass becomes the prevalent habitat type. On the dry rocky soils, mountain snowberry creates a phase of the Douglas fir/elksedge habitat type and on adjacent nonforested sites forms a mountain snowberry/subalpine big sagebrush community. At higher elevation, subalpine fir/elksedge is dominant.

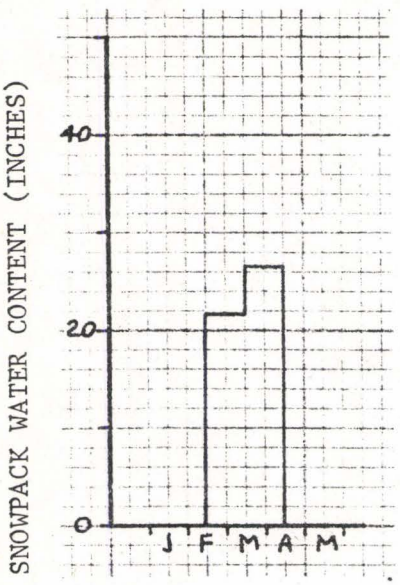
Nonforest associations can be characterized as follows:
At low to midelevations on south facing slopes, the mountain big sagebrush/bluebunch wheatgrass is the predominant type. On sites with coarse soils and disturbed sites, the bluebunch wheatgrass/oniongrass type is predominant and in some phases has an associated dominant of balsamroot. On midelevation south slopes, the mountain big sagebrush/mountain snowberry type is found. On sites with the most productive soils, at midelevation, the mountain big sagebrush/mountain brush type occurs. At the highest elevations on south slopes and ridge top sites the subalpine big sagebrush/elksedge becomes dominant. On disturbed sites and sites with coarse textured soils at these high elevations, the alpine knotweed type predominates, and a shrub community dominated by singlehead goldenweed occurs on sites where snow accumulates and lies late into the growing season.

Average annual precipitation ranges from 30 to 50 inches, with an annual runoff of 10 to 20 inches.

The following shows the range in precipitation that can be expected for 6- and 24 hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	2.0-2.4
10	24	2.8-3.4
25	24	3.0-3.8
10	6	1.5-1.7
25	6	1.8-2.0

Average snowpack for Dollarhide Summit, February through April is as follows:



MONTHS

DOLLARHIDE SUMMIT
ELEV. = 8620

Maintaining adequate ground cover under existing pressures of big game and livestock use is a key problem in the area as is developing an adequate road system to utilize the timber resource with tolerable impacts.

Subsection 6 - Smoky Mountain Subsection

The Smoky Mountain Subsection is an area of about 100,000 acres in the glaciated headlands portion of the South Fork of the Boise and Big Smoky Rivers. More than 80 percent of it lies between 8,000 and 9,500 feet. Big Peak and Two Point Mountains are about 10,000 feet. The valleys themselves are from about 7,000 to 7,800 feet in the South Fork of the Boise and from about 6,400 to 7,200 feet in the Big Smoky drainage. The area is dominated by the glacial troughs of the major drainages, the strongly alpine glaciated ridge systems and associated cirque headlands, and the valley train lands containing the stream themselves.

Some of the broad uplands at intermediate elevations protected from alpine glaciation have typical frost churned (cryic) characteristics with smooth weakly dissected slopes and deep to moderately deep, moderately coarse textured soils.

A few of the slopes which escaped glaciation are well dissected fluvial lands.

Granodiorite ("Atlanta" type) is dominant in the area. It is dominantly in weather classes 3 and 4 with inclusions (dominantly well fractured) of weathering class 5 and generally well fractured. Challis Volcanics and Wood River sedimentary rocks are common in the Big Smoky drainage.

Forest types in this area are similar to subsection 5 with Douglas fir and subalpine fir/elksedge the most typical situations. Nonforest associations can be described as follows:

At low to mid-elevations on south facing slopes mountain big sagebrush/bluebunch wheatgrass is the predominant type. On sites with coarse soils and disturbed sites, the bluebunch wheatgrass/oniongrass type is prominant and in some places has an associated dominant of balsamroot. On midelevation sites, the mountain big sagebrush/mountain snowberry type is found. On sites with the most productive soils at this elevation, the mountain big sagebrush/mountain brush type occurs. At the highest elevations on south slopes and ridge top sites, the subalpine big sagebrush/elksedge becomes dominant. On disturbed sites and sites with coarse textured soils at this elevation, the alpine knotweed type predominates. A shrub community dominated by single head goldenweed occurs on sites where snow accumulates and lies late into the growing season.

Average annual precipitation ranges from 40 to 50 inches and runoff from 15 to 20 inches.

The following shows the range in precipitation that can be expected for 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	2.2-2.4
10	24	3.2-3.4
25	24	3.0-4.0
10	6	1.6-1.8
25	6	2.0-2.2

Montezuma Fault Lands Subsection (7).

Subsection 7 - Montezuma Fault Lands Subsection

The Montezuma Fault Lands Subsection is a small 40,000-acre area comprised chiefly of the southeast headlands of the Middle Fork of the Boise River, James Creek, and the Yuba River. It is bisected by the Middle Fork and is bounded on the north by the Queens River Basin. The entire area lies above 5,000 feet with 70 percent of it lying between 6,000 and 8,000 feet and about 20 percent between 8,000 and 9,000 feet. Dominant local relief ranges from 1,000 to 2,000 feet.

Anderson (1939) described the most prominent features of the area starting with the Atlanta Basin bounded on the east by the Montezuma Fault scarp which separates the area from the Sawtooths to the east. The bedrock is chiefly quartz monzonite which is porphyritic in places (mainly in the Atlanta Hill area). Granodiorite and quartz diorite occupy the eastern portion of the subsection. Aplite and pegmatite dikes are common. Also, a dacite/granophyre dike swarm exists in a narrow belt across the subsection north of the Middle Fork of the Boise.

Older glacial deposits cap many of the ridges in the basin area and younger glacial materials fill the basin(s) itself. Most of the faulting activity was vertical (2,000-9,000 feet) except for the shear zone in the Atlanta Hill area which was formed by horizontal displacement.

The southern third of the area is comprised chiefly of Granitic Troughs and Headlands landtypes. Soils in this portion of the area are dominantly moderately deep to shallow sandy skeletal soils. The northern two thirds of the area has about the following landtype association composition and soils:

Landtype Association	Approx. Composition	Dominant Soils
Fluvial Granitic Lands	40%	Moderately deep to deep loamy to sandy skeletal.
Strongly Dissected Granitic Fluvial Lands	30%	Moderately deep loamy to sandy skeletal.
Steep Granitic Canyon Lands	10%	Shallow to deep coarse sandy to loamy (skeletal and nonskeletal).
Rejuvenated Cryic Lands	10%	Shallow and deep loamy and sandy skeletal.
Moraine and Alluvial Lands	10%	Deep loamy and sandy skeletal.

Douglas fir and alpine fir/pinegrass and Douglas fir and alpine fir/elksedge probably occupy much of the timbered portion of this unit with alpine fir/tall huckleberry on moist northerly aspects. The warm, dry, southerly aspects support Douglas fir/bluebunch wheatgrass, often with large amounts of oniongrass. Adjacent nonforested sites often support a bluebunch wheatgrass/oniongrass association, especially on unstable slopes. Other nonforested sites may support subalpine big sagebrush/bluebunch wheatgrass and subalpine big sagebrush/elksedge communities. Whitebark pine and subalpine fir may occur on the highest peaks and ridges.

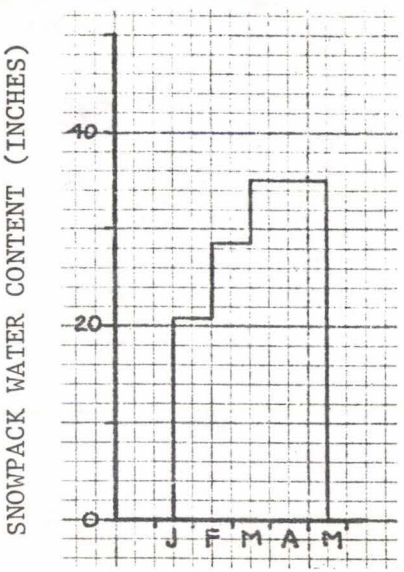
Average annual precipitation in the area ranges from about 40 to 50 inches and runoff from about 20-30 inches. The following shows the ranges in precipitation that may be expected from various intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	2.2-2.4
10	24	2.8-3.2
25	24	3.8-4.0
10	6	1.6-1.8
25	6	2.0-2.2

Chief management concerns are maintaining adequate vegetation cover for watershed, wildlife, and grazing purposes. Considerable pressure for recreation, subdivisions and mining are also important management factors.

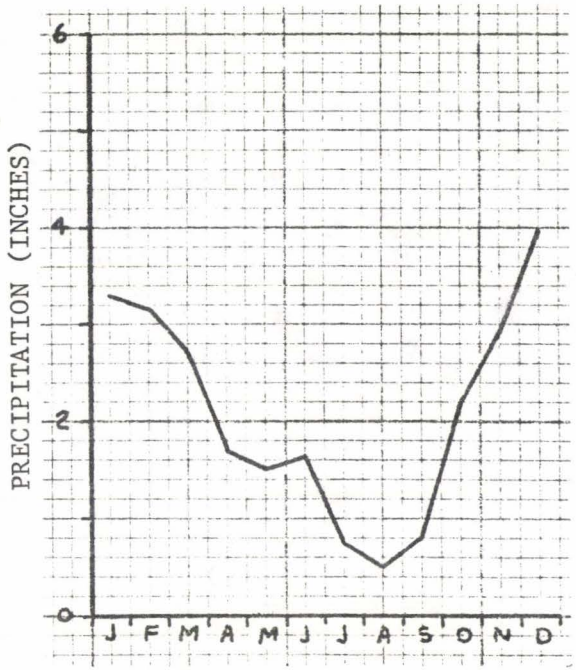
Figures 2, 3, and 4 show some other climatic data near Atlanta which is in the middle of the subsection.

Figure 2



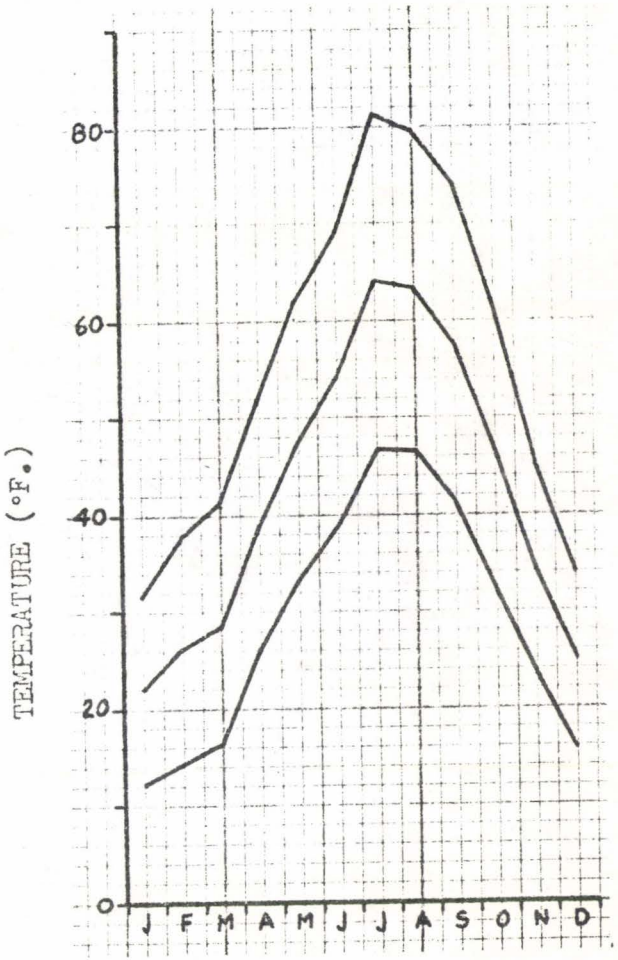
ATLANTA SUMMIT
ELEV. = 7500

Figure 3



ATLANTA 1E
ELEV. = 6000
YEARS = 17
A.A.P. = 25.17

Figure 4



ATLANTA 1E
ELEV. = 6000
YEARS = 8
55.7-42.3-28.9

Sawtooth Foothills Subsection (8).

Subsection 8 - Sawtooth Foothills Subsection

The Sawtooth Foothills Subsection contains the steep rejuvenated slopes to the west of the Sawtooth Mountain Range. This subsection is an expression of the west sloping tilted block faulting activity which formed the Sawtooths themselves. This area occupies a 40-mile long strip (10-15 miles wide) extending from Bull Trout Lake to Steel Mountain, and is cut by the South Fork Payette, the North and Middle Forks of the Boise Rivers. Although portions of some of the valleys were affected by valley glaciers, few glaciers of any magnitude had their origins in the area. Almost the entire area is above 5,000 feet with about three quarters of it between 6,000 and 7,500 feet. Dominant local relief ranges from 1,500 to 2,500 feet.

Bedrock is dominantly quartz monzonite in the northern part and granodiorite in the southern part. Dikes of intermediate porphyries, rhyolites and lamprophyres are common but to a lesser extent than in the adjacent South Fork Payette Canyon and Streamcut Subsection. White, finer grained quartz monzonite occurs as small bodies in the area as probable late stage differentiates of the Idaho Batholith.

The weathering, fracturing, and texture characteristics of the granitic bedrock vary widely in this subsection. These characteristics exert strong control on the relative stability of slopes in the area. For example, many of the slopes north of Steel Mountain towards the Middle Fork of the Boise River owe their relative stability to their weakly weathered and well fractured characteristics which make for efficient water handling characteristics and help mitigate the effect of the extremely steep slopes in the area.

About 25 percent of the area is in weakly to moderately dissected glacial troughs and landtype associations and a minor amount is glaciated headlands. Soils in these areas are dominantly shallow to moderately deep (depending upon position on the slope), sandy to coarse loamy skeletal. Only about 5 or 10 percent of the area is in periglacial landtype associations, and soils in these areas are generally moderately deep to deep, coarse loamy skeletal soils. Thirty percent of the area is in strongly dissected mountain slope lands with moderately deep to deep, coarse loamy skeletal soil. Steep granitic canyonlands occupy about 5 percent of the area in this unit where the South Fork of the Payette and the North Fork and Middle Forks of the Boise cross the area. Soils in this landtype association are shallow to deep, sandy to coarse loamy skeletal. The rest of the area is made up of a number of landtype associations, mainly of depositional lands and fluvial lands. Depositional lands are essentially deep, sandy to coarse loamy, skeletal and nonskeletal.

Douglas fir/spiraea and Douglas fir/ninebark occupy much of the lower elevations on south and north aspects respectively. On contiguous upper

slopes and ridges Douglas fir/elksedge and Douglas fir/pinegrass occur most. These two types will grade into alpine fir/elksedge and alpine fir/pinegrass at higher elevations with alpine fir/tall huckleberry occurring on northerly aspects having more moisture. The highest elevations support whitebark pine/alpine fir with small amounts of alpine fir/smooth woodrush at the heads of cirques. Some nontimbered situations may also occur on steep southerly aspects which are often a bluebunch wheatgrass/oniongrass community. Many of the steep south facing slopes at higher elevations have recently been reclassified as noncommercial timberlands because of their poor stocking and difficulty of regeneration.

Average annual precipitation for the area ranges dominantly from 30-45 inches and runoff from 20-40 inches. The following shows the range in precipitation of selected storm durations for various storm intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.8-2.4
10	24	2.8-3.2
25	24	3.4-4.0
10	6	1.5-1.7
25	6	1.8-2.2

No weather stations or snow courses are located in the area.

Many of the steep south facing slopes at higher elevations have recently been reclassified as noncommercial timberland. Debris slides and avalanches are common on the steeper slopes, near the heads of drainages. Just a small portion of this subsection west of Big Buck Mountain in the North Fork of the Boise River drainage lies in the Sawtooth Wilderness portion of the Sawtooth National Recreation Area. Most of this country outside the SNRA is presently unroaded. Gaining access with stable, low-impact roads will be difficult and may be possible in only a portion of the area. Such limitations may require many slopes containing commercial timber stands to be logged by aerial systems requiring a minimal amount of roads. The mountain slopes are generally of low quality for range use, but are part of the big game summer range.

Lowman Uplands Subsection (9).

Subsection 9 - Lowman Uplands Subsection

The Lowman Uplands Subsection is an area of about 130,000 acres consisting of dominantly moderately subdued, weakly to moderately dissected uplands. These uplands are drained largely by Crooked River, and about 90 percent of the area is between 5,000 and 7,500 feet. Dominant local relief ranges from 800 to 1,400 feet. This area appears to represent structural remnants of a land surface which was bisected by the South Fork of the Payette River. Similar, though smaller, surfaces appear as broad ridges immediately north of the South Fork of the Payette.

According to Larson and Schmidt, 1958 Road Log, the dominant bedrock is coarse quartz monzonite. This represents a change in rock type from the Atlanta granodiorite to the south in subsection 3. The contact between these two rock types may exert some structural control in the area. A strong lineal line lies along Mores Creek and should coincide with the contact region between the rock types. The controlling features of the area are the broad, rolling, upland appearance, the well-developed dendritic stream pattern in the area, and the coarse loamy moderately deep to deep soils overlying well weathered granitic bedrock. The weathering classes are dominantly 5 and 6 with minor inclusions of 4 and 7. Pegmatite and aplite dikes are common in the area.

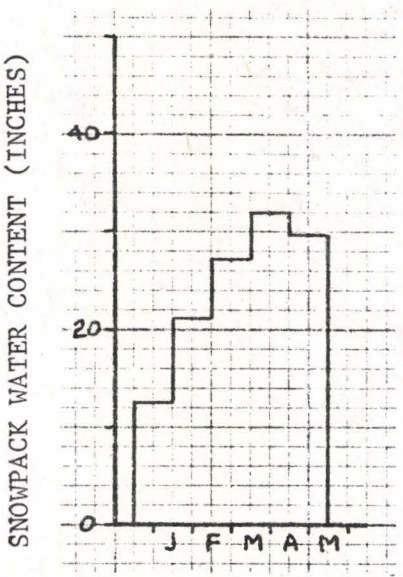
The dominant landtype association, as might be expected, is Mature Relief Fluvial Lands with moderate amounts of Rejuvenated Frost Churned (cryic) Mountain Slope Lands and a small amount of Glaciated Lands in the vicinity of Wolf Mountain. Minor amounts of Dissected Fluvial Lands occupy the southern portion of the area as it breaks off into the Middle-Fork Boise River Canyon and Streamcut Lands Subsection.

In this unit, Douglas fir/spiraea occupies much of the Douglas fir zone. Lesser amounts of Douglas fir/pinegrass and Douglas fir/elksedge occupy the thinner soils on upper slopes and ridges. At the upper elevations alpine fir/elksedge occurs on southerly aspects with alpine fir/grouse whortleberry on the adjacent northerly upper slopes and ridges. Many toe slopes and northerly midslopes in the same area support alpine fir/tall huckleberry. A few flat to gently rolling areas support persistent stands of lodgepole pine. These areas are associated with cold air accumulation throughout the year. Small amounts of alpine fir/dwarf huckleberry and alpine fir/marsh marigold occur in these areas.

Annual average precipitation is about 35-45 inches and runoff ranges from about 15-22 inches. Figure 1 shows the range in precipitation for selected duration storms for various storm intervals. Figure 2 shows the distribution of snowpack water content in inches for Mores Creek Summit and figure 3 shows the distribution of precipitation at Grimes Pass.

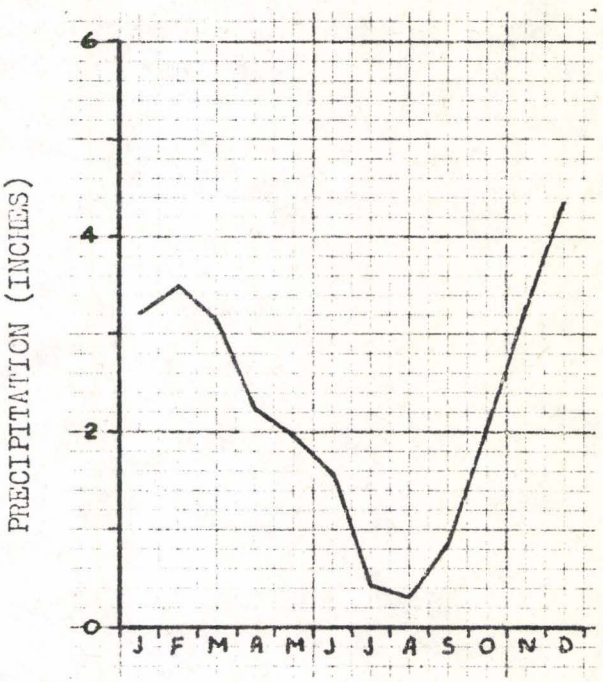
Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	2.0-2.2
10	24	2.8-3.0
25	24	3.0-3.6
10	6	1.5-1.7
25	6	1.8-2.0

Figure 2



MOORES CREEK SUMMIT
ELEV. = 6100

Figure 3



GRIMES PASS
ELEV. = 4980
YEARS = 18
A.A.P. = 26.89

This area is one of the higher timber production areas on the forest, at lower elevations at least. There has been some difficulty in getting regeneration started but it seems to be mainly a problem with pocket gophers. The area affords good opportunity to develop a roadnet coming in from above with little need to cross more hazardous landtypes with climbing roads out of drainageways. The objectives for a roadnet here would be to minimize the numbers of miles of road with a main access crossing the broad ridge system rather than in the drainage system. The sediment production hazard for the land is quite high but the delivery efficiency of the sediment is quite low. In other words, the ratio of sediment delivered to sediment produced by land management activities is quite low except for streamside roads and activities.

Boise Basin Subsection (10) looking north from Centerville; Boise Ridge-Payette Canyon Lands Subsection (10a) as viewed from the east.

Subsection 10 - Boise Basin Lands Subsection

The Boise Basin Lands Subsection is an area of about 150,000 acres consisting mainly of moderately subdued basin lands and weakly to moderately dissected uplands of relatively low relief. The basin is drained largely by Grimes and Mores Creeks with about 90 percent of the area between the elevations of 3,900 and 7,000 feet. The south half of the area has a median elevation of about 4,700 feet and a dominant local relief ranges from 1,000 to 1,800 feet. The north half of the area has a median elevation of about 3,800 feet and a dominant local relief ranging from 800 to 1,200 feet.

Larson and Schmidt (1958) identified the bedrock in the area as mostly quartz monzonite. However, the area contains a wide variety of associated granitic rocks with finer grained varieties of quartz monzonites. Anderson (1943) also identified numerous dikes and the dike swarms. The most common rock type in the dike swarm area is a quartz hornblende biotite monzonite porphyry. Other kinds of dike material include pegmatites, aplites, and lamprophyres.

The lowest lying lands in the subsections were largely filled with alluvium over a complex structural geologic history. Anomalies in the section include ancient lakes, sediment remnants, and highly weathered nongranitic bedrock which both have a tendency to give rise to somewhat finer textured soil materials than are found in adjacent subsections. These kinds of anomalies have also produced a series of mass wasting slopes in the southern portion of the basin area. These slopes have considerable mass stability problems and have associated suspended sediment problem.

About 50 percent of the subsection is in the Mature Relief Fluvial Lands landtype association. These lands typically have a finely meshed dendritic stream pattern and give an overall rounded appearance; also the characteristic weathering of the granitic bedrock is generally weathering classes 5 and 6, with inclusions of weathering 7 and 4. Soils are variable but generally moderately deep to deep, sandy to coarse loamy in texture. Inclusions of fine loamy textures are common and they may be skeletal (35% coarse fragments). These lands have a moderate to moderately high soil erosion potential in response to management practices but delivery efficiences to streams are moderately low to low. About 25 to 35 percent is in the Moderately to Strongly Dissected Granitic Fluvial Land landtype association. Soils in this association generally range from shallow to moderately deep, have sandy or coarse loamy textures with some subsoils being skeletal. About 10 percent is in the Fluvial Lands landtype association adjacent to the major streams. Soils in this association may be made up of a series of depositional strata. In any case substrata layers are generally sandy and skeletal. Adjacent to or below the granitic fluvial land, clayey

soils are more common to some of the older landtype remnants. The rest of this subsection is made up of a miscellaneous group of other landtypes, like Structurally Controlled Granitic Fluvial Lands. The steeper landscapes are found near the headlands of this unit.

Douglas fir/spiraea and Douglas fir/ninebark characterize the dry and moist slopes of this unit. Lesser amounts of ponderosa pine/bitterbrush, ponderosa pine and Douglas fir/common snowberry and ponderosa pine and Douglas fir/pine mountain snowberry occur on appropriate microsites.

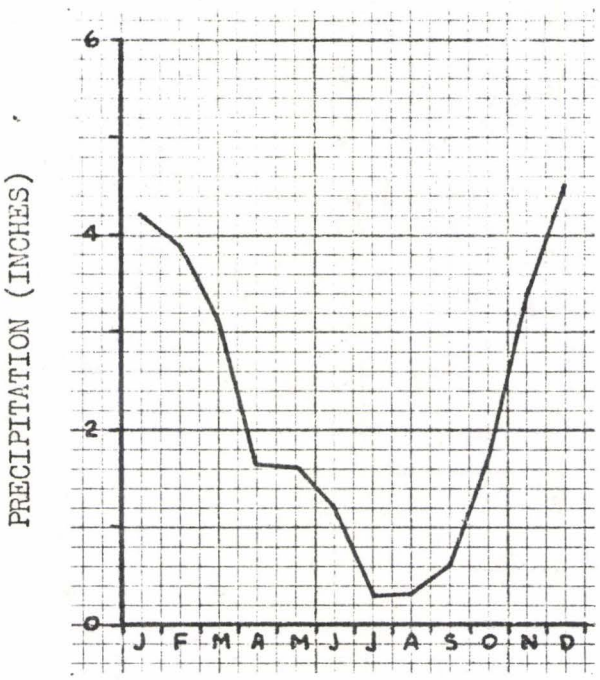
In the central portion of this unit are many areas of flat to gently rolling terrain. Climax understories here appear to be pinegrass or elksedge but there is little evidence of Douglas fir replacing the present stands of ponderosa pine. For the present, these sites are best recognized as ponderosa pine/pinegrass and ponderosa pine/elksedge community types requiring more study for habitat type designation.

Average annual precipitation ranges from about 20 to 30 inches with an average annual runoff of 5 to 10 inches. Figure 1 shows the range in precipitation for 6- and 24-hour storm duration periods at selected interval of reoccurrence.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.6-1.8	
10	24	2.4-2.6	2.2
25	24	2.8-3.4	
10	6	1.4-1.5	
25	6	1.6-1.7	

Figures 2 and 3 show the distribution of precipitation and the average annual maximum, minimum, and mean temperatures at Idaho City respectively. Figures 4 and 5 show the distribution of precipitation at Centerville and Crouch respectively. Figure 6 shows the snowpack water content which gives an idea of what snowcover can be expected.

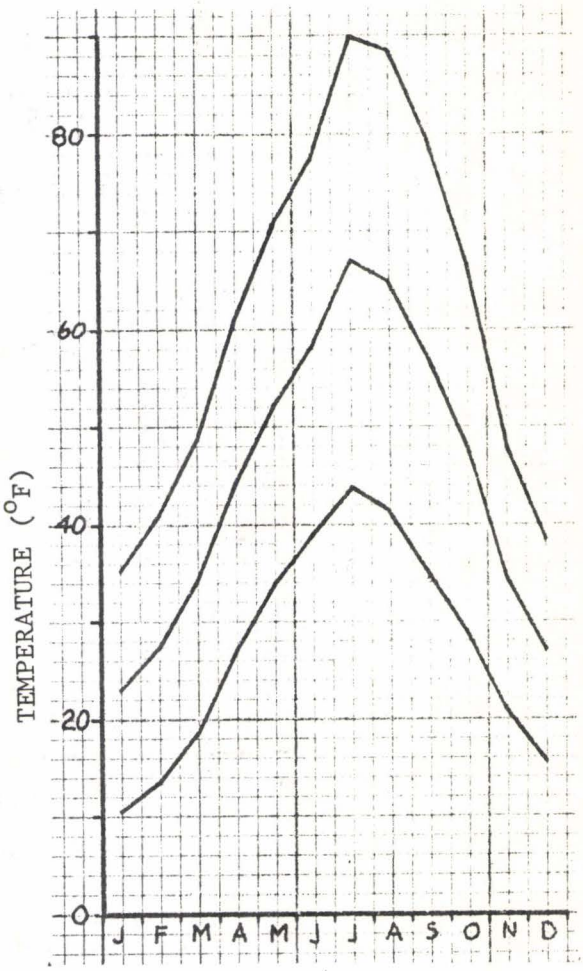
Figure 2



MONTHS

IDAHO CITY 11SW
ELEV. = 5000
YEARS = 30
A.A.P. = 26.58

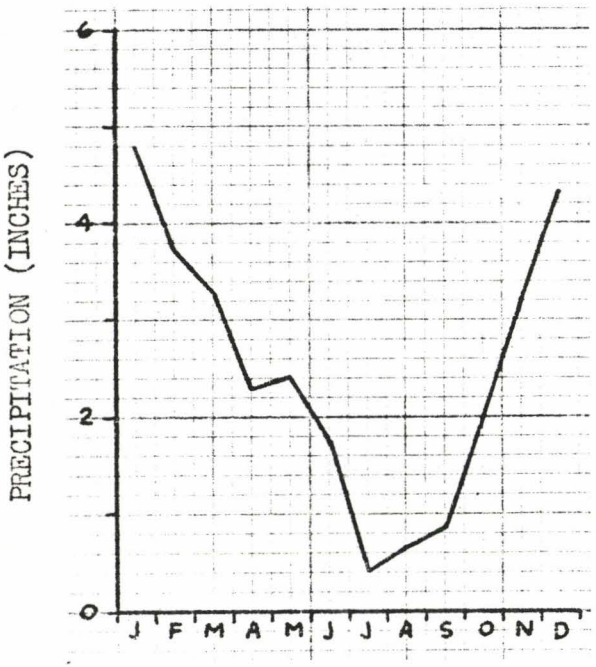
Figure 3



MONTHS

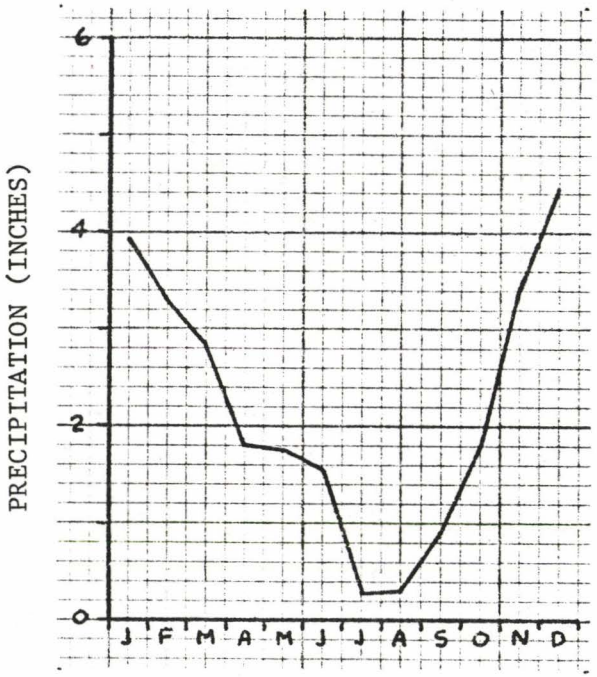
IDAHO CITY
ELEV. = 4000
YEARS = 30
62.1-44.8-27.3

Figure 4



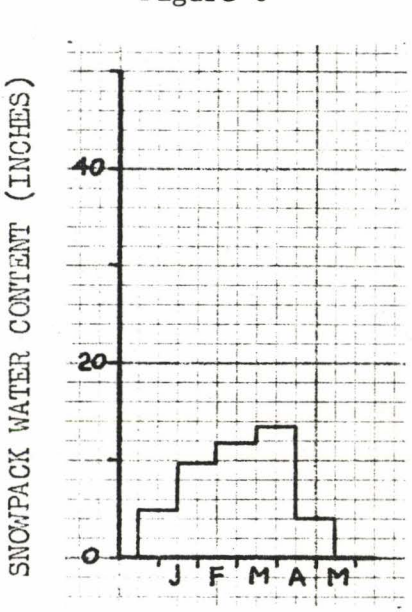
CENTERVILLE—ARBAUGH RANCH
ELEV. = 4780
YEARS = 11
A.A.P. = 29.73

Figure 5



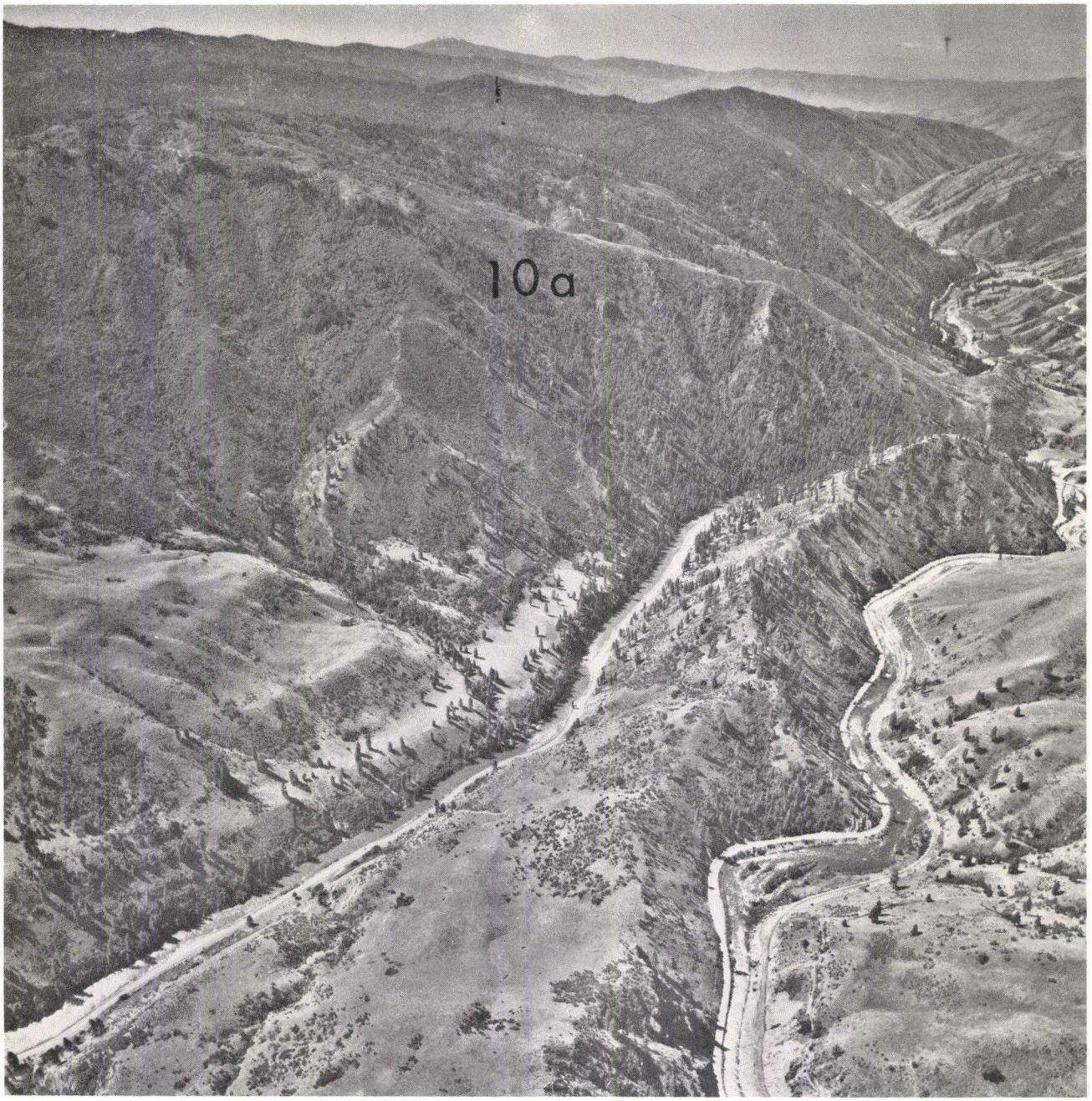
CROUCH 2NNW
ELEV. = 3100
YEARS = 25
A.A.P. = 26.36

Figure 6



BAD BEAR
ELEV. = 5500

The challenge to managing these lands in the future is considerable. The production potential for timber in the Mature Relief Fluvial Lands is quite high when compared to the rest of the lands in the Forest. The character of the lands gives them considerable flexibility of management allocation and careful selections will have to be made to meet the needs of the public in the future.



Looking south at Boise Ridge-Payette Canyon Lands Subsection (10a).

Subsection 10a - Boise Ridge-Payette Canyonlands Subsection

The Boise Ridge-Payette Canyonlands Subsection is a long, narrow (approx. 10 miles by 55 miles) subsection which extends northward from just east of Boise to just west of Alpha in Long Valley. It is bounded on the north by the Long Valley Foothills Subsection. It is bounded on the west by the Intermontane Physiographic Province. It includes Boise Ridge System, and almost the entire North Fork drainage south of Round Valley and portions of the main Payette Canyon drainage to Horseshoe Bend. This is a complex unit and is more or less transitional from the Northern Rocky to the Intermontane Provinces. About 80 percent of the area is between 4,000 and 6,800 feet. About 15 percent of it is above 6,800 feet with a maximum elevation of just over 8,000, and about 5 percent of it is below 4,000 feet. Dominant local relief ranges from 1,000 to 2,500 feet.

Bedrock on the west between Lucky Peak and Horseshoe Bend is mainly the Idaho and Payette formations. These are young relatively incompetent sediment groups of rocks. The ridge itself, in the vicinity of Charter's Mountain, has been capped by basalt flows which show the transitional nature of the subsection to the Columbia Intermontane Province. The center core of the Boise Ridge north of the South Fork of the Payette River contains a belt of quartz diorite, but the rest of the bedrock in this portion of the area can be considered granitics. From Horseshoe Bend to Banks the granitic rock has been altered somewhat, evidently by the intrusions of basaltic flows through the granitic body giving rise to a more brightly colored, slightly altered appearance of the bedrock.

The rest of the granitics, however, are a pretty straightforward mixture of quartz monzonite and granodiorite. Rock weathering classes 2 through 7 are well represented in this area, with fracturing classes from 2 to 6 common. Smooth, frost churned (cryic) upland slopes are only weakly expressed in this subsection above elevations of 7,000 feet. Soils with surface aeolian (wind borne) characteristics can be commonly observed on the ridge north of the South Fork of the Payette River.

About 30 percent of the area is in the Strongly Dissected Granitic Fluvial landtype association. These have typically steep, sharp ridges and sharp draws that dissect the slope at relatively close intervals. Bedrock underlying these landscapes is dominantly in weathering classes 4 to 6, with inclusions of 7 and 3 between elevations of 4,500 to 6,000 feet. Soils are shallow to moderately deep and generally have sandy or coarse loamy textures and some soils are skeletal when bedrock is less weathered. About 25 percent of the area is in the Moderately Dissected Fluvial Granitic landtype association. The bedrock in these lands is dominantly more highly weathered than the lands in the Steep Strongly Dissected Granitic Fluvial Lands. Soils again are commonly coarse loamy to sandy, with depths ranging from moderately deep to deep. About 10

percent of the area is included in the Steep Granitic Canyonlands landtype association which have extremely steep slopes of 60 to 80 percent.

Soils on Steep Granitic Canyonlands are dominantly shallow to moderately deep and generally have coarse loamy or sandy textures and are often skeletal. About 15 percent of the area is in the Xeric Granitic Fluvial landtype association. These slopes are typically treeless and are generally warm and bare of snow most of the year. These occur typically on south exposures and at lower elevations.

A small portion (less than 5 percent) is in the Frost Churned (cryic) landtype association. These slopes are at the highest elevation and generally south of the Payette River and exhibit weak frost churned characteristics. These lands have the highest snowpacks and coldest climatic regime. Soils in these areas are typically deep, sandy to coarse loamy, and often skeletal.

The rest of the area is made up of a number of landtype associations ranging from Mature Relief Fluvial Lands, Structurally Controlled Granitic Fluvial Lands, Mass Wasting Fluvial Lands, and a number of others. The soils in the area are typical of the granitics except for the Mass Wasting Fluvial Lands which have a tendency to be somewhat finer textured. Also, the inclusion of fine loamy soils is rather common in the Charter's Mountain-Hawley Peak area, and at the head of the structurally controlled lands, and upland and at the head of Scriver Creek.

At lowest elevations in this unit, subalpine big sagebrush/bluebunch wheatgrass and subalpine big sagebrush/Idaho fescue habitat types occur respectively on south and north aspects. These two types prevail over most of the area below lower timberline except locally near Horseshoe Bend where the sagebrush is scarce to absent.

In many areas, a narrow band of mountain snowberry/chokecherry separates the sagebrush zone from lower timberline. This mountain shrub community often overlaps with the timber and reflects a ponderosa pine or Douglas fir/mountain snowberry habitat type. In this unit, this habitat type is usually the chokecherry phase.

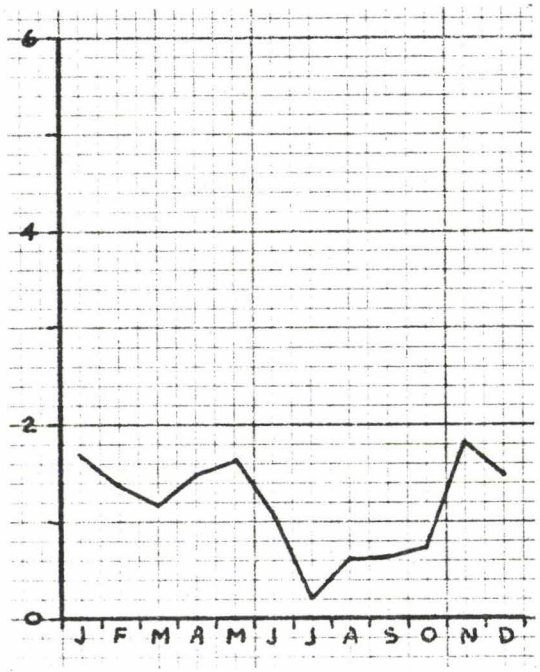
Douglas fir/spiraea and Douglas fir/ninebark occupy much of the timbered area. Special topoedaphic features often support lesser amounts of Douglas fir/pinegrass and Douglas fir/common snowberry. In the northern quarter of this unit, grand fir/tall huckleberry occurs on protected sites that also support the southern limits of western larch. Small amounts of alpine fir/tall huckleberry can be found along cool drainages and upper north slopes.

Average annual precipitation ranges from about 18 to 35 inches with a runoff ranging from about 5 to 10 inches per year. Figure 1 shows the range in precipitation from 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.4-1.8	
10	24	2.2-2.6	2.0
25	24	2.6-3.0	
10	6	1.3-1.5	
25	6	1.5-1.7	

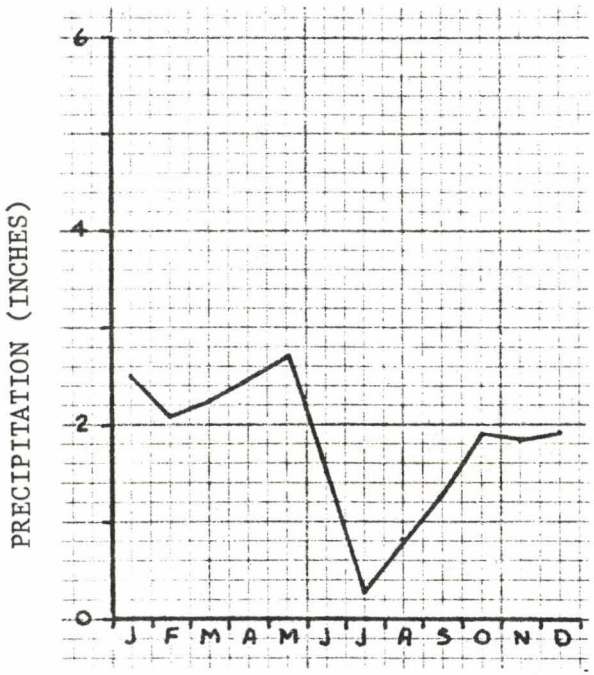
Figures 2 and 3 show the distribution of precipitation from two rather contrasting elevations which show the same relative distribution. Figure 4 shows the mean maximum, mean minimum, mean annual temperatures of one of the lower elevations of the area. Figures 5, 6, and 7 show the snowpack water content for three medium-to-high elevations, which show the distinct relationship to elevation.

Figure 2



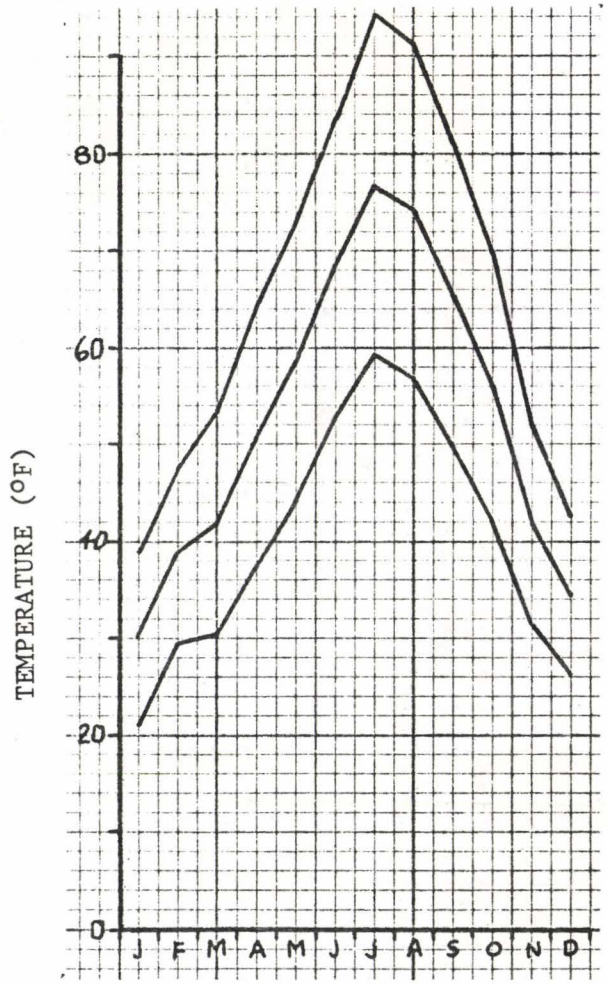
BOISE LUCKY PEAK DAM
ELEV. = 2840
YEARS = 9*
A.A.P. = 13.97

Figure 3



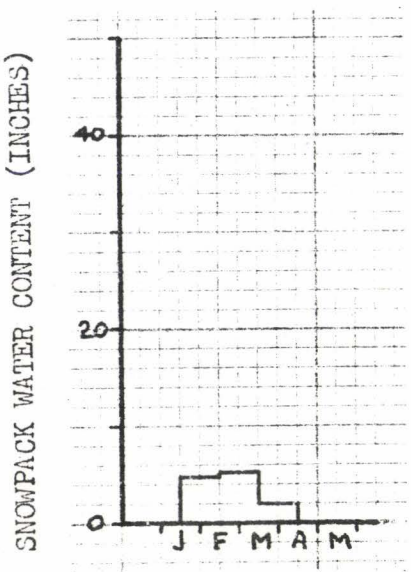
DEER POINT
ELEV. = 7150
YEARS = 10*
A.A.P. = 21.54

Figure 4



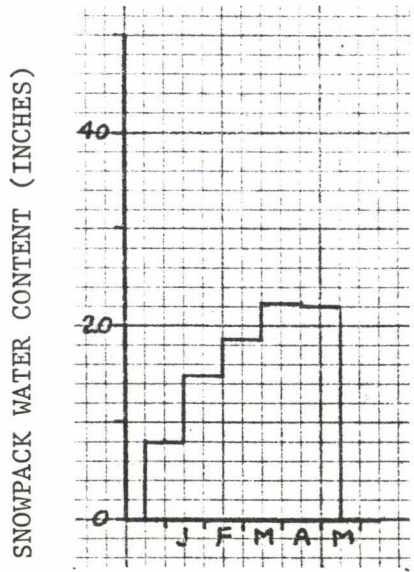
BOISE LUCKY PEAK DAM
ELEV. = 2840
YEARS = 9*
66.0-53.1-40.2

Figure 5



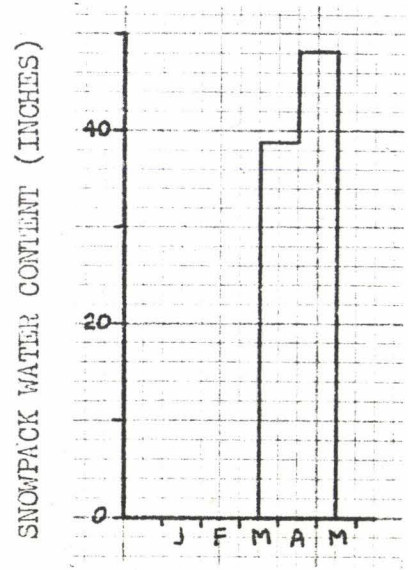
BOGUS BASIN ROAD
ELEV. = 5360

Figure 6



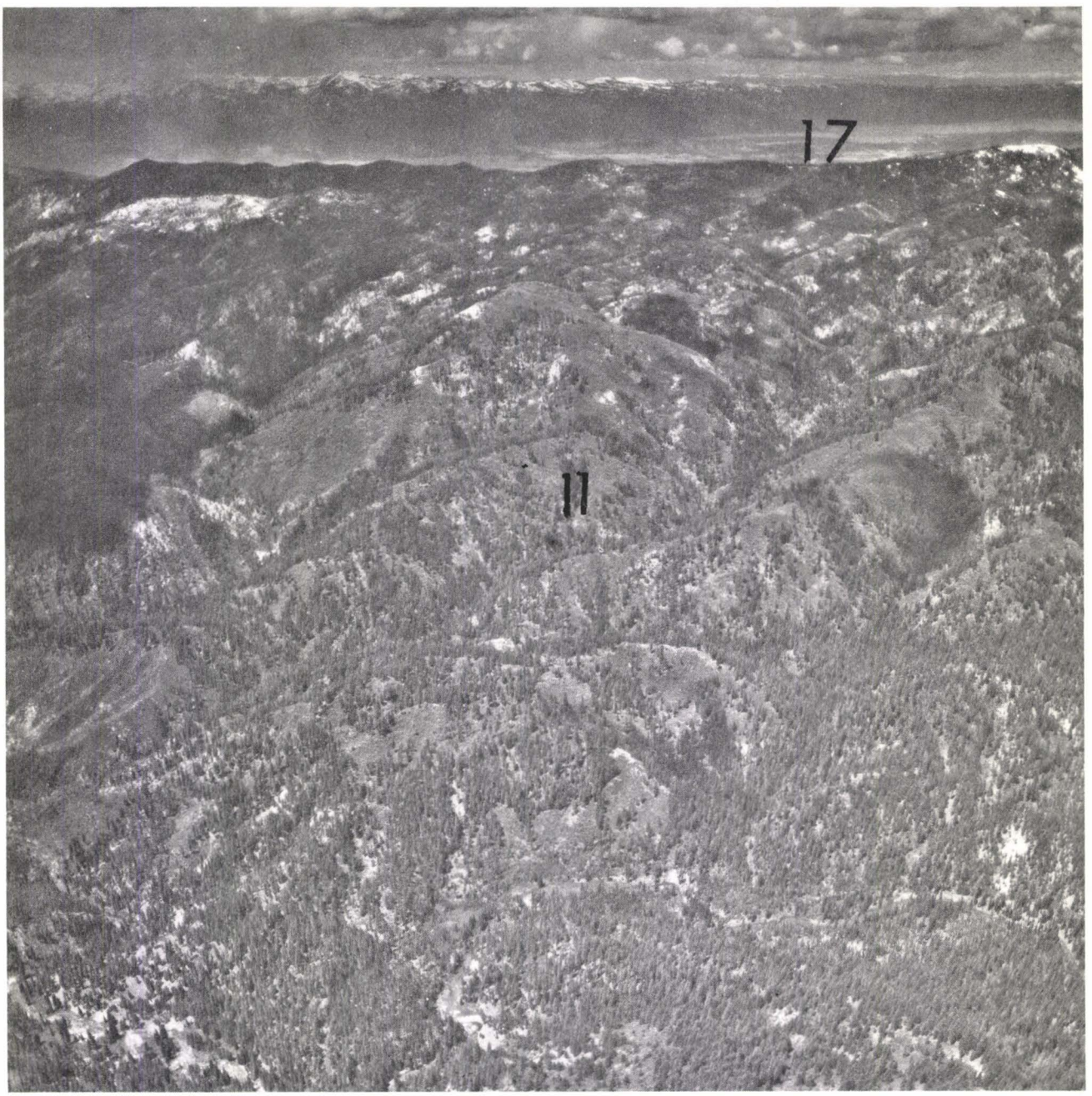
BOGUS BASIN
ELEV. = 6120

Figure 7



OROGRANDE MOUNTAIN
ELEV. = 7800

This area has relatively high values for a number of resources: Recreation-skiing, hunting, fishing, hiking, casual day use, timber, big game. It also has some relatively fragile characteristics from its dry south lower elevational slopes to its high sediment producing steep slopes at intermediate and high elevations. Management of an area like this so close to a metropolitan area will present challenges of the highest order.



Looking west across Middle Fork Payette Canyon and Streamcut Lands Subsection (11). Long Valley Subsection (17) in background.

Subsection 11 - Middle Fork Payette Canyon and Streamcut Lands Subsection

The Middle Fork Payette Canyon and Streamcut Lands Subsection is an area of about 200,000 acres consisting dominantly of moderately steep and dissected to steep and strongly dissected mountain slope lands in the Middle Fork of the Payette drainage ranging in elevation between about 4,000 and 7,500 feet. Only a few peaks like Scott Mountain and East Mountain are higher. The area has a median elevation of about 5,500 feet and a dominant local relief ranging from 1,000 to over 2,000 feet. Evidence of glaciation has its strongest expression in Bull Creek but is also weakly expressed in some of the drainages emanating from the divide between the Deadwood and Middle Fork of the Payette Rivers. Many slopes and uplands adjacent to the glaciated areas (however weakly expressed) have smooth, relatively undissected features which are characteristic of frost churned (cryic) slopes generally found nearby glaciated areas.

The drainages are generally deeply incised indicating a response to changes in base levels caused by faulting and uplift. Many of the slopes are strongly rejuvenated with rapid natural geologic erosion rates. It appears that some of the uplift is fairly recent and may even be going on now. The entrenchment of the Middle Fork near Railroad Pass gives some evidence that some of the lands at the present head of the Middle Fork of the Payette may have drained into the headwaters of the South Fork of the Salmon River.

The middle and upper quarter of the main drainage, along with the lower third of Silver Creek and most of the tributary drainages like Anderson and Bulldog Creeks, are deeply entrenched on the landscape. The Silver Creek Basin is a structural feature which is somewhat anomalous with the rest of the subsection, although similar features like Warm Lake and Deadwood Basins are present in adjacent subsections.

Bedrock in the area is chiefly quartz monzonite east of the river and granodiorite west of the river with a minor amount of dike swarms extending from the south into this subsection. Aplites, pegmatites and quartz diorite are found in the southwestern portion of the subsection.

Soils in the area have the typical depth-topographic position relationship where soils on the spur ridge (interfluves) are typically 16-24 inches to bedrock to over 6 feet in some of the swales and draws. (Tree and brush roots can readily penetrate fracture planes in weathering class 5 and most of the rock matrix in weathering class 6.) Depths are commonly 2 to 4 feet thick on 40 to 55 percent slopes. Soil textures are dominantly coarse to moderately coarse textured. None of the soils classified had a textural B horizon.

Douglas fir/ninebark dominates most of the moderate sites in this unit. Douglas fir/spiraea occurs most often on the warmer drier aspects in the

same areas. Lesser amounts of Douglas fir/common snowberry can be found on the deeper soils of toeslopes while ponderosa pine/bitterbrush is common on the thinner soils of ridges.

With increasing elevation and cooler temperatures, Douglas fir/pinegrass and Douglas fir/elksedge appear on the upper slopes and ridges, while grand fir/spiraea, grand fir/tall huckleberry, and finally subalpine fir/tall huckleberry appear on protected moist slopes and bottoms. Some of the highest peaks and ridges are capped with subalpine fir/elksedge, usually the subalpine big sagebrush phase.

At upper elevations a few streambottoms have accumulated glacial and alluvial deposits which now support persistent stands of lodgepole pine in the subalpine fir/dwarf huckleberry habitat type.

Precipitation in the area ranges from 25 inches near Crouch to over 50 inches at the highest elevations. Runoff ranges from about 5 to over 20 inches. The 24-hour precipitation that can be expected in a 2-year period ranges from about 1.8 to 2.2 inches. The 2-year, 6 hour storm which can be expected is about 1.1 to 1.3 inches. The 10-year, 6-hour storm ranges from about 1.5 to 1.7 inches.

The area as a whole has a naturally high sediment production capacity. Experience has shown us, however, that the combination of rejuvenated slopes, coarse textured soils, and spalling weathered rock when roaded for any reason increased the sediment delivered to streams at many times their natural rates. The prime example is in Anderson Creek which has yet to recover from the Cow Creek timber sale activity in about 1950.

Sawtooth Mountains Subsection (12).

Looking south across Sawtooth Mountains Subsection (12) from Goat Lake.

Subsection 12 - Sawtooth Mountain Subsection

The Sawtooth Mountain Subsection is an area of about 185,000 acres that is mainly the result of high-angle, westward tilting, block faulting activities and subsequent alpine glaciation. The steep east flank slopes mark the District boundary on the east. The more weakly expressed Montezuma Fault near Atlanta approximately marks the western boundary of the area.

This area is characterized by its serrated ridges and typical landforms associated with strong alpine glaciation: Aretes, Matterhorns, Nonataks, Cirques, Cirque Lakes, hanging valleys, rock glaciers, glacial troughs, etc. The area still contains a few small active glaciers. Elevation ranges from about 5,000 feet to almost 11,000 feet. The median elevation is about 8,300 feet and dominant local relief ranges from 2,000 to 4,000 feet.

Geology in this is well described by Rolland Reid and is reproduced in full. See map at the end of this subsection.

> The Thompson Peak metamorphic rocks may record Precambrian sedimentation and metamorphism in the Stanley area. The next major event in the geologic record, Paleozoic sedimentation, is known largely from neighboring areas. One small patch of carbonate rocks of the Wood River Formation is in the map area.
>
> The intrusion of the Idaho Batholith, in Cretaceous time, is the oldest geologic event clearly recorded in the Sawtooth area. Later came the intrusion of large volumes of more silicic magma, producing the white quartz monzonite. (NOTE: We map this as part of the Idaho Batholith.) An episode of mineralization may have occurred in conjunction with this event. Pegmatites formed late in each of the two kinds of batholithic rocks.
>
> The next recorded event is the intrusion of andesite, trachyandesite, and latite dikes, probably in early Challis time. Trachyandesitic flows and related volcanic breccias probably formed at this time also. These events were followed by the intrusion of silicic magma, resulting in the Sawtooth Batholith, roughly in medial Challis time. One or more episodes of mineralization then ensued, interspersed in uncertain order with the injection of northeast-trending dikes of rhyolite, lamprophyre, andesite, latite, and aplite. At least part of the mineralization postdates most of the foregoing dikes. Entirely post-mineralization were hornblende trachyandesite dikes, intruded in late Challis time.
>
> Diabase dikes, injected along northwest-trending fissures came next, probably in Miocene time. Some faulting movement may have occurred at this time.

Late in Tertiary time or perhaps even in Pleistocene time, faulting uplift of the Sawtooth block occurred, along N 20°-30° W faults. Intense glacial erosion ensued; evidence of two Wisconsin advances of ice is found in the range.

Over 80 percent of the area is in the Glaciated Headlands and Glaciated Trough Lands landtype association. The higher elevations are essentially above timberline. Vegetation in the lower elevations is mostly in the subalpine fir and Douglas fir series. Many of the glacial troughs are very raw, thin-soiled, sandy and skeletal in nature (more than 35 percent coarse fragment). In these kinds of glacial troughs avalanche paths are numerous. Other troughs are somewhat older and have thicker soils and are more heavily vegetated. These generally are in the lower elevations. The granitic fluvial lands occupy about 10 percent of the area or less. The rest of the area is made up of depositional lands, including the ground moraines and lateral moraines and some of the more gentle slopes around the edges of the area have what can be termed rejuvenated frost churned (cryic) granitic land. Soils in the above areas range from sandy to coarse loamy, dominantly shallow to deep but mainly moderately deep and most of them are stony although many are relatively stone free.

The dominant forest habitat types in this section are the Douglas fir/elksedge, the subalpine fir/elksedge and the subalpine fir/grouse whortleberry. Some pockets of Douglas fir/pinegrass are also present. Much of the current timber occupying these sites is seral lodgepole pine.

Subalpine big sagebrush/elksedge, mountain big sagebrush/Idaho fescue and mountain big sagebrush/bluebunch wheatgrass occupy suitable sites on dry south slopes and in some dry bottom areas.

A complex of several different meadow communities occupies the stream-bottom and cirque basin areas from low to high elevations.

The whitebark pine barren zone occurs at the highest elevations in the area with a number of subdivisions within including tallus slope, cushion plant and several mesic to hydric types in the higher cirque basin and surrounding environs.

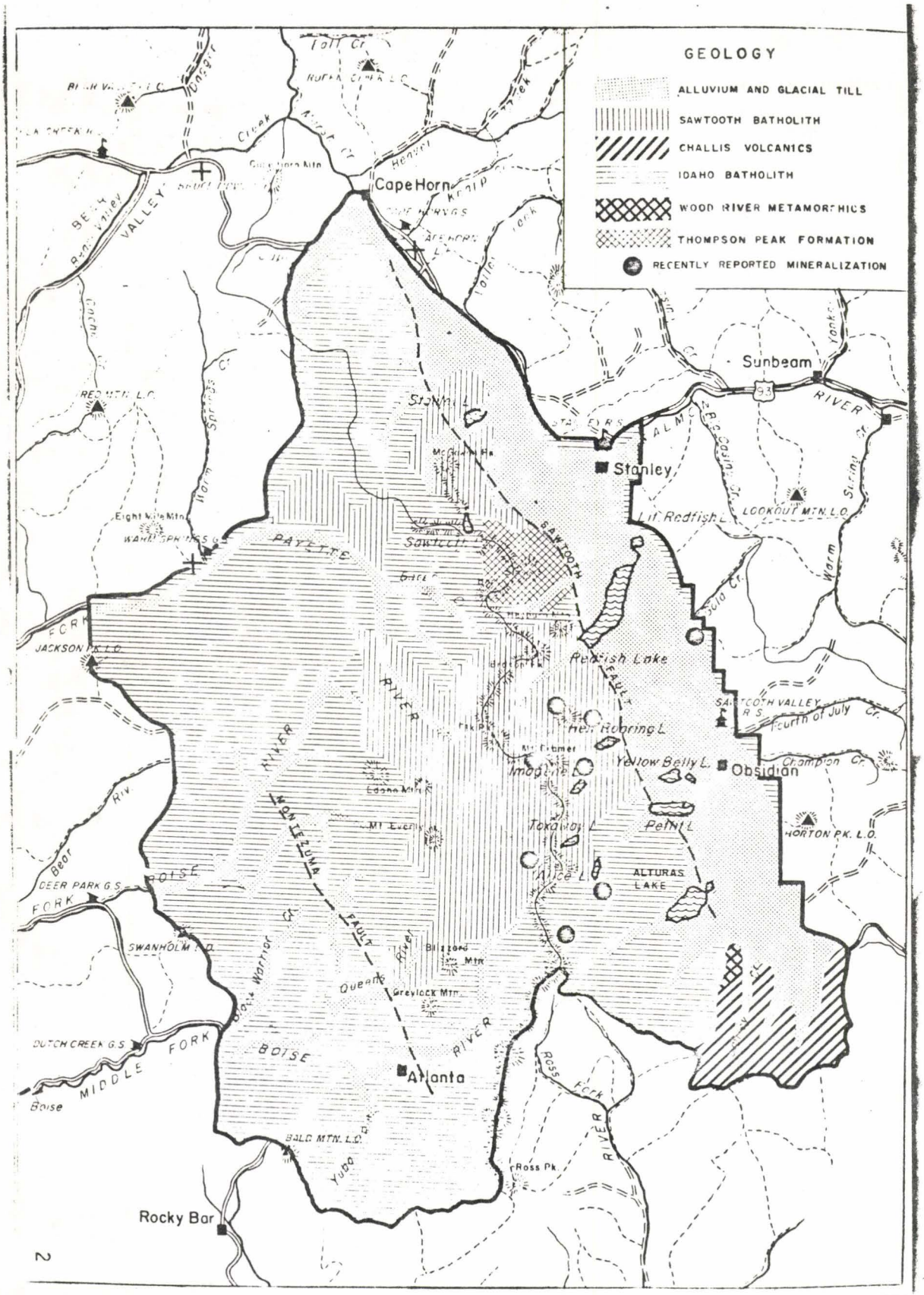
On lower elevations on the western side of the Sawtooths the ponderosa pine/bluebunch wheatgrass and Idaho fescue types are found particularly associated with glacial outwash and ground moraines. Douglas fir/pine-grass occupied with seral ponderosa pine is also common this side of the Sawtooths.

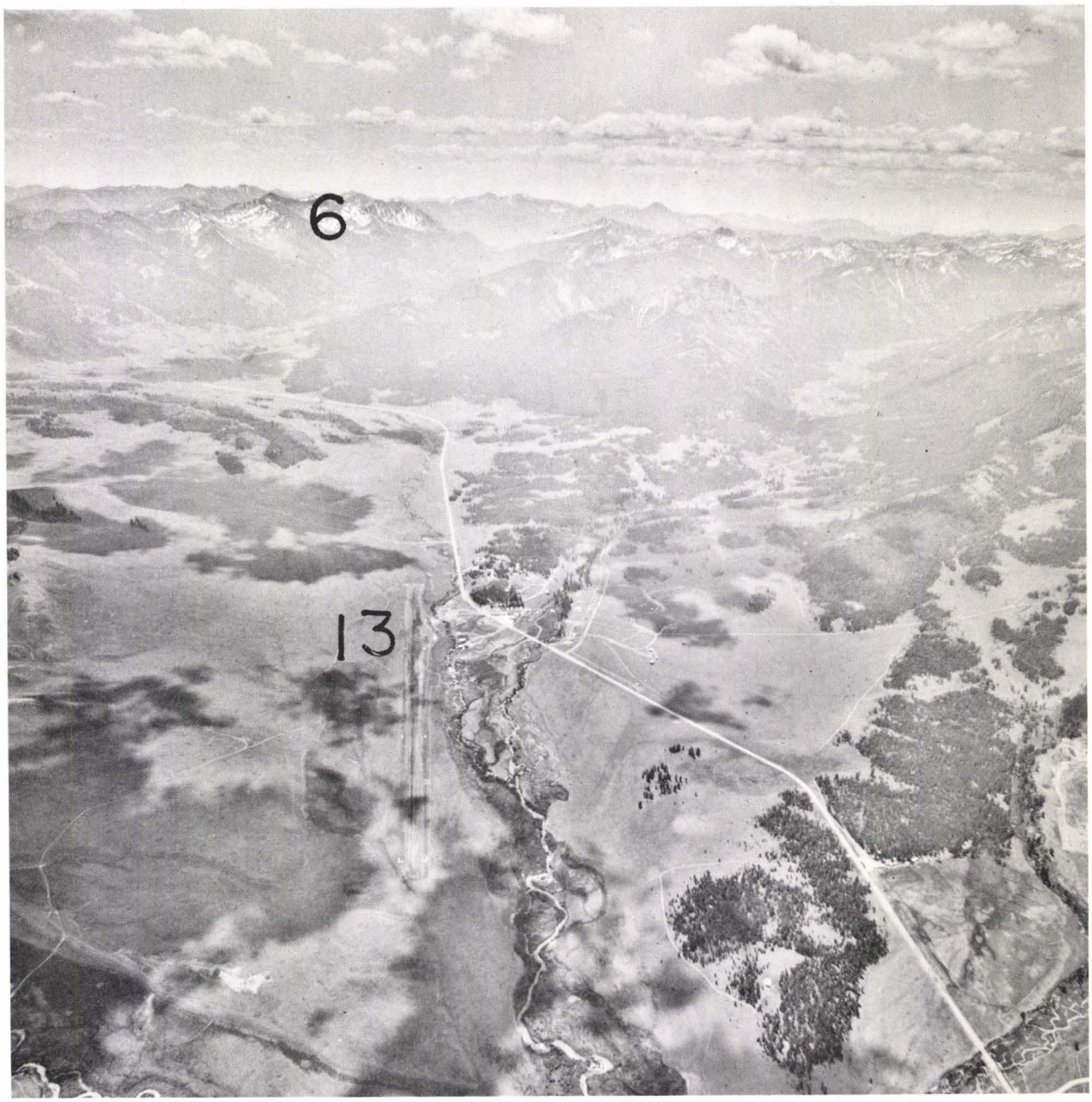
The average annual precipitation ranges from 30 to 60 inches in this area and runoff is about 20 to 40 inches, constituting one of the highest water production areas in southern Idaho. The following shows

the range in precipitation of 24 six-hour duration storms occurring at various selected intervals. The area contains no other weather stations and a summary of its characteristics was given by Walter Megahan in a special report of the area.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.8-2.5	
10	24	2.8-3.4	
25	24	3.0-4.2	
10	6	1.5-1.9	
25	6	2.0-2.2	1.8 & 2.3

The management qualities of this area have already identified that most of this subsection is in Sawtooth Wilderness Area and the Sawtooth National Recreation Area. The challenges to management mainly revolve around managing sensitive ecosystems.


GEOLOGY
ALLUVIUM AND GLACIAL TILL
SAWTOOTH BATHOLITH
CHALLIS VOLCANICS
IDAHO BATHOLITH
WOOD RIVER METAMORPHICS
THOMPSON PEAK FORMATION
RECENTLY REPORTED MINERALIZATION
Cape Horn
Sunbeam
Stanley
Obsidian
Atlanta
Rocky Bar
Boise
Redfish Lake
Yellow Belly L.
Petit L.
Toxaway L.
Alice L.
ALTURAS LAKE
Sawtooth
Greylock Mtn.
Blizzard Mtn.
Ross Pk.
Eight Mile Mtn.
Eagle Mtn.
Mt. Evelyn
Mt. Cramer
Imogene
Horton Pk. L.O.
Lookout Mtn. L.O.
Red Mtn. L.O.
Jackson Pk. L.O.
Bald Mtn. L.O.
Deer Park G.S.
Swanholm L.O.
Dutch Creek G.S.
Wahlsprings G.S.
Sawtooth Valley R.S.
Fourth of July Cr.
Champion Cr.
Lit. Redfish L.
Toll Cr.
Beaver Cr.
Warm Spring Cr.
Solid Cr.
Yuba
Ross Fork
Middle Fork
Boise River
Bear River
Payette River
Wood River
Big Wood River
Sawtooth
Salmon River
Alturas Lake Creek
Queens River
Warm Springs Creek
Valley
Fault
Creek
Fork
Basin
Lake
Peak
Mtn.
Ridge
Valley
Creek
Warrior Cr.
Bear Riv.
Boise
Middle
Fork
Boise
River
Ross
Fork
River
Yuba
Rocky Bar
Atlanta
Stanley
Sunbeam
Obsidian
Cape Horn
Redfish Lake
Yellow Belly L.
Petit L.
Toxaway L.
Alice L.
Alturas Lake



Looking south down Stanley Basin Subsection (13) into Smokey Mountain Troughlands Subsection (6) of the Southern Batholith Section (I).

Subsection 13 - Stanley Basin Subsection

The Stanley Basin Subsection occupies about 150,000 acres in the filled basin along the east fork of the Sawtooth Range. Elevation ranges from about 6,200 to almost 8,000 feet. The area has a median elevation of about 7,000 feet and two distinct sets of dominant local relief: one set is 100 feet or less in the outwash plains and the other set of 500 to 800 feet in the moraine lands. The basin here includes the Upper Salmon River Valley as well as the Valley Creek drainage. Both valleys are assumed to have structural origins, essentially being the downthrown (or graben portion) of the tilted block faulting activities which apparently took place in late Tertiary or even early Pleistocene time. There is strong evidence to suggest that Valley Creek and the Upper Salmon River drainage once flowed in a northwesterly direction, but have since been captured by the head-cutting activities by the Salmon River.

Glacial drift consisting of both moraines and alluvial deposits is abundant in the Stanley Basin, and to a much lesser extent along the westward stream courses.

Glaciers emerging from the range reached out into the basin and built great embankments of rock debris along their melting margins. These are the moraines which are easily identified because the heterogeneous character of the drift retains enough moisture to support a thick growth of lodgepole pine. In contrast, the well sorted alluvial deposits do not hold moisture and only sagebrush and other dry environment plants are able to exist under these conditions.

Many of the moraines, particularly where the debris of the lateral and terminal moraines have merged, acted as dams across the east-flowing streams and created the fine Piedmont lakes of the basin.

The moraines are largely confined to the west side of the basin and because of their deposition, have forced the Salmon River eastward in its valley; in some places the ice or moraines dammed the river to form lakes. Beyond the moraines are the outwash fans deposited by streams issuing from the melting glaciers. These are quite well developed on both sides of the basin, indicating that the material was carried by glacial streams from higher gound on either side of the basin.

Williams has found good evidence of two episodes of major glaciation in the mountains and Stanley Basin. These he correlates with the Bull Lake and Pinedale stages of western Wyoming. Unlike the Wyoming material, however, the moraines of the two stages here are largely superimposed. This is attributed to the topographic conditions at the time of each advance. The Bull Lake glaciers spread laterally in the Piedmont area and were, therefore, shorter than if they had been confined in narrow valleys. The Pinedale glaciers, although not having the mass nor the extent of the Bull Lake glaciers, advanced as far into the basin, for they were restricted to channels cut into the Piedmont moraine belt.

Bull Lake deposits are distinguished from Pinedale ones by the greater weathering of the drift and their topographic and stratigraphic positions.

Today's streams are reworking the glacial till of Stanley Basin and the gravels of the Payette and Boise Rivers and their tributaries. Erosion continues, being particularly evident in the high country where talus slopes are prominent.

The Stanley Basin province occupies the Stanley Valley area on the east side of the study area. It extends from Cape Horn on the northern tip of the area almost to the southern tip with its axis oriented about 30° west of north. The range in elevation for the area is about 6,300 feet to 7,500 feet. Slope gradients range from essentially flat up to 50 percent with a predominance of slopes from 5-25 percent.

The western portion of this province has the typical subdued, hummocky appearance characteristic of glacial, moraine lands. The remainder of the area is made up of reworked moraine material and valley alluvium. Large glacial troughs through the moraine land form the drainageways of some of the major streams in the area. Some of these troughs are partially occupied by lakes such as Redfish, Alturas, and Yellow Belly. However, most of these troughs are occupied by stream or lake deposited valley fill.

The chief similarity of many soils developed on the glacial, stream, and lake deposited materials in the Stanley Basin physiographic province is the extreme thickness of the unconsolidated substrata. Depths to bedrock are unknown under many of these soils, but it is reasonably certain to exceed 100 feet. The soils developed from lake deposits and some streams are deposits relatively free of coarse fragments. The soil textures of soils from lake deposited materials are consistently finer textured than other soils in this province and have fine sandy loam to silt loam surfaces and silt loam to silty loam subsoils. Most stream and glacial deposited soils contain high percentages of coarse fragments. These coarse fragments are subrounded to rounded cobble-size fragments but may be gravel-size to boulder-size. The fragments commonly comprise about 20 percent of the surface layers and about 40 percent of the subsoils. However, many surfaces on these kinds of lands have been reworked by stream action. This stream action has deposited a layer of fine sandy loam to sandy loam textured materials in some depressions. This deposition has generally been at the expense of the low hummocks in the microrelief. The hummocks, consequently, are generally very cobbly on the surface.

Soil textures on these lands in the Stanley Basin province are quite variable. Textures vary mainly with the geologic composition of the other deposits and the mode of deposition. For example, soils in this province at the upper (southern) end of the basin are derived from

glacial till and outwash which contain considerable amounts of rock materials from the Challis volcanics and Wood River formation. Surface textures for these soils range dominantly from sandy loam to loam (commonly gravelly to cobbly). Subsoils are dominantly gravelly to cobbly loam to light clay loam and substrata dominantly cobbly sandy loams. The central portion of the basin, particularly on the moraine lands on the west side of the basin, is composed chiefly from granitic materials, and textures are dominantly gravelly to cobbly sandy loam to loamy sand surfaces and gravelly to cobbly loamy sand to sand subsoils and substrata. However, textures as fine as sandy clay loam are common in the subsoils and substrata in this area.

Textures of many of the soils developed on stream deposited materials in the Stanley Basin province, as well as elsewhere in the study area, also reflect the influence of parent materials. For example, alluvial soils in drainages north of Redfish Lake to Thatcher Creek reflect the influence of Thompson Peak metamorphic and intrusive dike materials and are somewhat finer textured than soils developed essentially from alluviums of granitic composition. This is also true of the terraces along Horn Creek. Generally, the same relationships exist between geology and mode deposition in other provinces as described for soils in the Stanley Lake Basin physiographic province. Consequently, the soils in these provinces have about the same ranges in texture and coarse fragment content, but are dominantly less deep to bedrock.

Although most of the soils in the Stanley Basin province are well drained, many of them are flooded for a portion of the year and high water tables are common. These soils commonly have mottled colored and somewhat finer textured subsoils and substrata. Peats and mucks occur in places on these wet lands.

The predominant vegetation on the drier glacial outwash terraces along the Salmon River is mountain big sagebrush/Idaho fescue. Some poorly drained and/or rocky sites are occupied by thermopola low sagebrush/Idaho fescue. In some of the major tributaries and higher benches along the main Salmon River and along Valley Creek lodgepole pine/Idaho fescue is the dominant timber type. In some side drainages the subalpine fir/dwarf huckleberry type is prominant. Meadows associated with the latter type are the beakedsedge, watersedge and tufted hairgrass meadow types.

The predominant timber types on the lateral and terminal moraines are the Douglas fir/elksedge, subalpine fir/elksedge and subalpine fir/grouse whortleberry types. Extensive acreage of all these types is now occupied by seral lodgepole pine.

Average annual precipitation ranges from 20-35 inches and runoff 10 to 20 inches. Figure 1 shows the ranges in precipitation for 6- and 24-

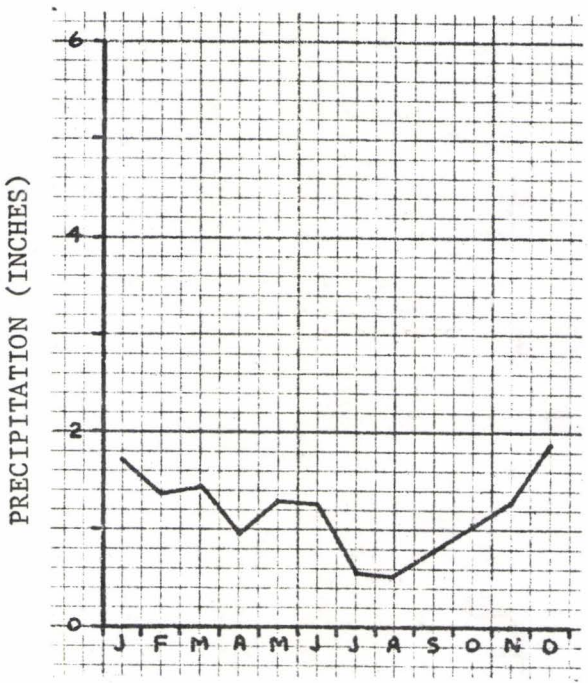
hour duration storms which can be expected from selected storm interval periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.6-2.2
10	24	2.8-3.0
25	24	2.6-3.0
10	6	1.2-1.5
25	6	1.7-2.0

Figures 2 and 3 show the distribution of precipitation and the mean maximum, mean minimum, and mean temperatures for Obsidian. Note the effect that total precipitation at Obsidian is relatively low indicating a rain shadow effect of the Sawtooth Range itself. Also note that the mean minimum temperatures indicate that frost can occur any given day of the year.

Figures 4, 5, and 6 show the snowpack water content of three stations at varying elevations. They show relationship between two things: the increase in snowpack with elevation and the effect of the rain shadow, the Vienna Mine being the westernmost station receiving far more snowfall and a slightly different in elevation from Galena Summit.

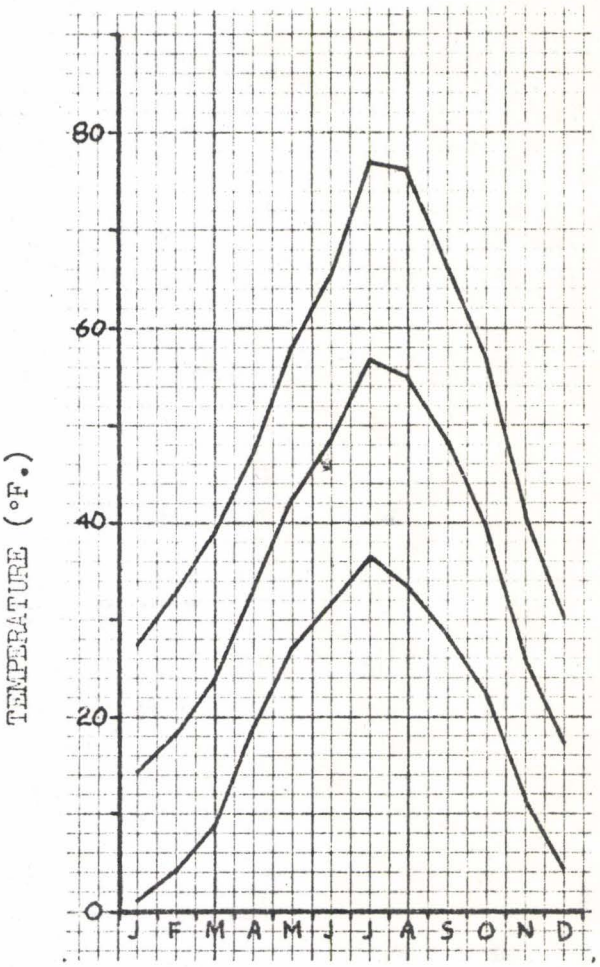
Figure 2



MONTHS

OBSIDIAN 3SSE
ELEV. = 6870
YEARS = 30
A.A.P. = 14.15

Figure 3



MONTHS

OBSIDIAN 3SSE
ELEV. = 6870
YEARS = 30
51.6-35.4-19.1

Figure 4

GALENA
ELEV. = 7300

Figure 5

GALENA SUMMIT
ELEV. = 8795

Figure 6

VIENNA MINE
ELEV. = 8900

Looking south into Sawtooth Mountains Subsection (12) and Stanley Basin Subsection (13) across Stanley Foothills Subsection (14).

Subsection 14 - Stanley Uplands Subsection

The Stanley Uplands Subsection lies adjacent to and east of Stanley Basin mainly between elevations of 6,500 and 9,000 feet. The area has a median elevation of about 8,000 feet and a dominant local relief ranging from 1,000 to 1,500 feet. About 80 percent of the area shows the effects of glaciation, much of it depositional in nature. The lake country at the headlands of Beaver Creek appears to have been heavily scoured by a thick ice sheet. The drainage bottoms in the Beaver, Knopff, and Valley Creek drainages are deeply filled with alluvium from melting ice south of Valley Creek. The broad rolling uplands between 7,500 and 8,500 feet have smooth, relatively undissected surfaces and deeper soils (2 to 3 1/2 feet), typical of frost churned (cryic) slopes.

Moderately to strongly dissected and canyonland slopes occupy the lands to the east of Redfish Lake and in the Main Salmon Canyon. Soils on these areas are dominantly 15-30 inches deep and moderately sandy to coarse loam, typically nonskeletal.

The granitic bedrock in the softly rolling topography is generally in weathering classes 4 to 5 and 3 to 4 in the more dissected lands. Several areas just north of the Salmon River are covered by Challis volcanics, mainly latite and andesite.

Bennett in 1973 described the pie-shaped section of Idaho Batholith just east of Stanley. The rock type in this area is primarily granodiorite at elevations of above 7,000 feet and quartz monzonite below 7,000 feet. Pegmatites and aplites are localized in the lower quartz monzonite section. This vertical zonation is interpreted as a differentiation in-place by the original Batholith magma. The igneous rocks in this subsection were described by Choate in 1962 as being coarse grained, porphyritic granitics in the east which graded to fine to medium grained granitics in the west. A tertiary quartz latite dacite prophyry complex was described near Stanley Creek and is similar to other dike swarms previously mentioned. Choate mentioned terraced evidence of two stages of glaciation in the area and can be related to Pinedale-Bull Lake sequences. The linear map of the Challis AMS sheet shows strong linears along the Salmon River Valley Creek and most other drainages in the area. This is typical of the Batholith drainage system as most of the other major streams are probably also fault controlled.

About two-thirds of the slopes are timbered with Douglas fir and subalpine fir habitat types. The open slopes are mainly sagegrass and brush grass slopes. The predominant forest habitat type on this subsection is the Douglas fir/pine grass. Also occuring are the Douglas fir/elksedge on midelevation south slopes and Douglas fir/Idaho fescue on drier south slopes.

The dominant subalpine fir types are the subalpine fir/grouse whortleberry and the subalpine fir/elksedge. In stream bottoms and some cool-air drainage situations on drier sites, the subalpine fir/bluejoint grass and subalpine fir/dwarf huckleberry types are found.

On south slopes, mountain big sagebrush/Idaho fescue and mountain big sagebrush/mountain snowberry occur interfingered with the timber typed. Average annual precipitation ranges from about 20 to 40 inches with runoff from 5 to 20 inches. Most of the precipitation in this area is off the snow and is probably quite similar to the range between that found on the Sawtooth Subsection in the Stanley Basin Subsection. There is probably some rain shadow effect from the rain to the west. Summers have warm days and cool nights, winters are long and cold. The following shows the rain precipitation for 6- and 24-hour duration storms at various return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.4-1.8
10	24	2.0-2.6
25	24	2.6-3.0
10	6	1.2-1.5
25	6	1.5-1.7

Management challenges associated with the area are chiefly a combination of short growing season, xerix situations on south slopes, and difficult establishment of vegetation regeneration upon harvesting coupled with the relatively high sediment-producing potential on the slope which is somewhat ameliorated by the moderate delivery efficiencies of the sediment produced.

Bear Valley-Landmark Basin and Uplands Subsection (15), looking east.

Subsection 15 - Bear Valley-Landmark Basin and Uplands Subsection

The Bear Valley-Landmark Basin and Uplands Subsection is an area of about 380,000 acres extending from the Salmon River Canyonlands along the East Fork of the South Fork of the Salmon River on the north to the South Fork of the Payette Canyon and Streamcut Lands on the south. It is drained to the north by Johnson Creek, to the south by Deadwood River, and to the east into the Middle Fork of the Salmon by Sulphur Creek, Elk Creek and Bear Valley Creek. This subsection is dominated by broad, deeply filled valleys and rolling uplands which clearly show the remnant characteristics inherited by their glacial and periglacial past.

Both Bull Lake and Pinedale morainal materials have been identified in the area. The rock materials of the older Bull Lake are generally more highly weathered and are also found 1 to 4 miles farther down valley from the fresher Pinedale deposits. In addition, periglacial activities and subsequent erosional processes have left much of the area with overriding smooth, weakly dissected characteristic, typical of past arctic landscapes. Typical alpine glaciated landforms, however, are restricted to the highest ridge systems. The area includes some steep, essentially unglaciated slopes associated with the horst ridge system which formed Deadwood Basin as well as with more localized block faulting activities. The Deadwood River and Johnson Creek give strong evidence of following the chief fault line associated with the Deadwood fault.

Elevations of the filled valleys are about 6,600 $\pm$ 200 feet. There appears to be another set of concordant surfaces at about 7,000 feet expressing itself in the smooth, frost churned uplands. Peaks of 8,000 $\pm$ 400 feet dot the area mainly around the margin of the area. These higher elevations contain some of the alpine glacial landforms. The higher elevations appear related to the expressions of the block faulting in the area.

Bedrock is mostly coarse quartz monzonite, with granodiorite in the northern part of the area.

Dominant soil families in the area by landtype association are as follows:

Strongly Glaciated Land (20%)
About 70 percent shallow to deep skeletal sandy
About 30 percent shallow to deep skeletal loamy

Fluvial Lands (25%)
About 30 percent moderately deep to deep loamy skeletal
30 percent moderately deep to deep sandy skeletal
10 percent shallow-sandy
20 percent moderately deep sandy and loamy

Depositional Lands (20%)
About 70 percent deep sandy skeletal
30 percent deep loamy skeletal
Some with high water tables

Cryic Uplands (35%)

About 60 percent moderately deep to deep sandy skeletal
25 percent moderately deep to deep sandy
15 percent moderately deep to deep loamy

Broad valley bottoms that accumulate cold air flows typify this unit. These frost conditions are reflected in the dominance of lodgepole pine of timber stands through the valley bottom. On the driest of these areas, lodgepole pine/Idaho fescue is the prevailing habitat type. With increasing moisture, a subalpine fir/Vaca habitat type occurs in both the wet (bluejoint wheatgrass) and dry (dwarf huckleberry) phase. Small inclusions on bottoms and gentle slopes that developed from a log condition are now a subalpine fir/Cabi habitat type. With increasing elevation above the valley floor and less frost, subalpine fir/whortleberry or subalpine fir/elksedge occur depending on soil moisture. Subalpine fir/Vasc also becomes more prominent on northerly aspects and upper ridges especially toward the southeasterly end of this unit. On mid to upper south slopes, Douglas fir/Caru, Douglas fir/Cage, and Douglas fir/Agsp occupy sites with varying amounts of soil moisture.

Wet meadows are dominated by sedges and rushes with willows near streams and areas of extremely high water tables. Dry meadows are dominated by the oatgrasses, hairgrass, and bluejoint.

Average precipitation in the area ranges between 25 and 60 inches. Water equivalent of the snowpack recorded at the Deadwood Summit course has been over 46 inches (among the highest in the State). Almost the entire area is generally snow covered from December through April. Runoff from the area ranges from about 10 to over 20 inches. The following is a list of storms which can be expected at various intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.5-2.4
10	24	2.4-3.4
25	24	2.8-3.6
10	6	1.5-1.8
25	6	1.7-2.2

Chief problems in range management are associated with getting proper balanced use of wet and dry meadows and giving adequate streambank protection to the salmon spawning streams in the area (Elk Creek and Bear Creek).

Chief problems in timber management are associated with bringing the relatively low value subalpine fir habitat types under productive management. Early regeneration and utilization problems are among the critical problems. Maintaining proper temperature ranges for maintenance of proper fishery environment will be an important consideration in timber harvesting activities.

South Fork Payette Canyon and Streamcut Lands
Subsection (16) looking in southwesterly direction.

Subsection 16 - South Fork Payette Canyon and Streamcut Lands Subsection

The South Fork Payette Canyon and Streamcut Lands Subsection is an area of about 200,000 acres consisting of the land entrenched by the Payette River and portions of its main tributaries (like the Deadwood River and Clear Creek) from Garden Valley east to Canyon Creek. Landtype associations in the middle and lower elevations consist dominantly of Strongly to Moderately Dissected Granitic Fluvial Lands and Canyon Lands. About 25 percent of these lands are xeric in nature (supporting ponderosa pine habitat types or treeless grass or brush vegetation). Upper elevations consist dominantly of rejuvenated frost churned (cryic) slopes in the headland position and frost churned uplands on the ridges. Only minor amounts of glaciated lands occur at the highest elevations on the northern edge. Elevations range from 4,000 feet near the Garden Valley Ranger Station to about 8,500 feet on the canyon ridges. Median elevation is about 5,800 feet and dominant local relief ranges from 1,000 to 3,000 feet. Some of the frost churned (cryic) broad ridges in the country between the Clear and Warm Springs drainages north of the river appear to be concordant with the broad Lowman Uplands to the south and to some of the land surfaces in the Landmark-Bear Valley Basin and Uplands subsection on the north.

Bedrock in the areas is dominantly coarse quartz monzonite, but the central portion of the area is cut by a swarm of dikes that are mainly andesitic to rhyolitic in nature (many are phorphritic). Jointing planes in the upper South Fork Payette Canyon above Lowman, generally parallel the slope on south slopes. Although the granite bedrock is dominantly fairly competent (weathering classes 2 to 3) in the entrenched canyons, much of the bedrock is in weathering classes 4 and 5 with weathering class 6 common.

In the Warm Springs and Chapman drainages and along the South Fork Canyon, considerable abnormally weathered bedrock (possibly hydrothermal activity) is present. Naturally barren slopes are present.

Soils in the area are dominantly in sandy and sandy skeletal families with about 20 percent in loamy skeletal families; only about 30 percent are shallow (< 20" to bedrock); 50 percent 20-40 inches to bedrock and 30 percent > 40 inches to bedrock.

Most of this area lies below the subalpine fir zone. Only in the upper elevations do subalpine fir/blue huckleberry and subalpine fir/grouse whortleberry occur as the major representatives of the subalpine fir series. One of the primary habitat types here is Douglas fir/ninebark which occurs on northerly aspects. Douglas fir/white spiraea and sometimes Douglas fir/snowberry occupy the warmer sites in the same area. In this area all three Douglas fir habitat types support vigorous ponderosa pine.

With lower elevations or warmer conditions ponderosa pine/snowberry and some ponderosa pine/bitterbrush become the common forested types. Drier aspects in the same area support bluebunch wheatgrass/Poa and or Purshia communities.

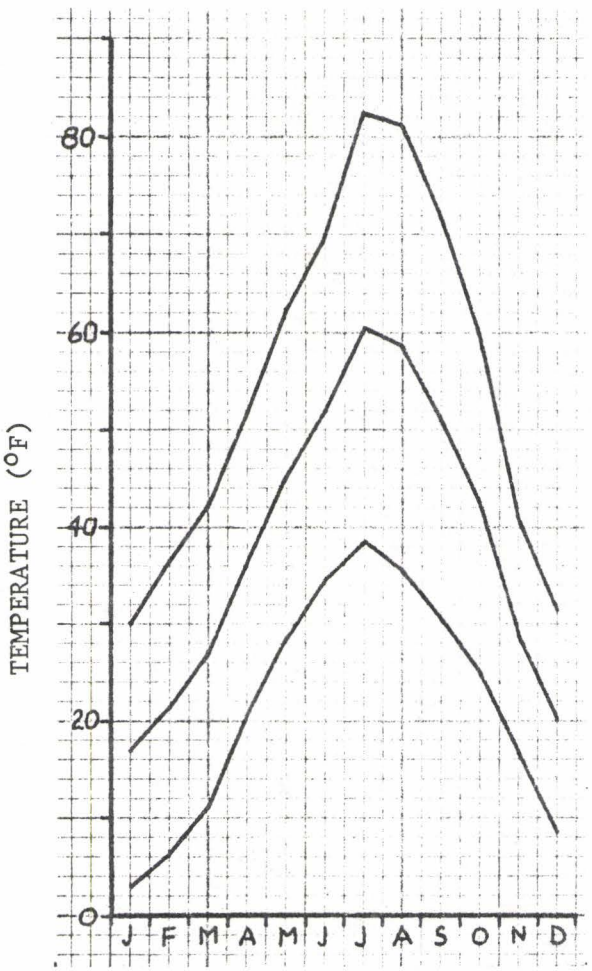
South facing slopes below 5,500 feet seldom have persistent snow. North facing slopes on northerly aspects above 7,000 feet, on the other hand, are almost always snow covered from December through April.

Average annual precipitation ranges from 30 to 45 inches with runoff ranging from 10 to 20 inches.

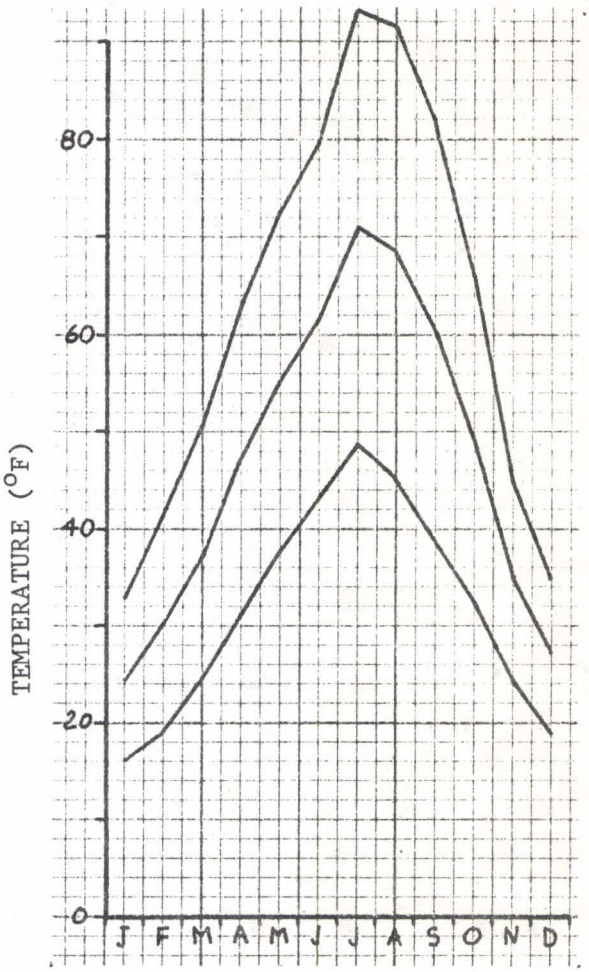
The following shows a list of storms of two selected durations which can be expected at various intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.8-2.4
10	24	2.6-3.2
25	24	3.0-3.6
10	6	1.5-1.8
25	6	1.7-2.0

The following are tables of mean maximum, mean, and mean minimal temperatures for Deadwood and Garden Valley.



DEADWOOD DAM
ELEV. = 5375
YEARS = 30
55.0-38.3-21.6



GARDEN VALLEY R.S.
ELEV. = 3212
YEARS = 30
62.8-47.2-31.8

The chief management problems associated with the area are road construction on steep slopes, big game winter range management, and access development to resources.

Subsection 17 - Long Valley Subsection

The Long Valley Subsection consists of a long valley of about 250,000 acres extending from just north of Smiths Ferry to Payette Lake, about 50 miles in length and about 8 to 10 miles in width. It includes the towns of McCall and Cascade. Also included (making up about 10 percent of the area) in this area is the West Mountain Ridge and Slope. This, the valley itself, is a fault block basin which has been filled by fluvial and glacial deposits. The vertical extent of these deposits is impressive. Based on a seismic survey Schmidt and Mackin, 1970, reported over 7,000 feet of sediment in Long Valley. The basalt capped West Mountain border fault scarp is 3,000 feet making a total vertical fault displacement of 10,000 feet. This fault extends 100 miles north to Grangeville and 60 miles south to Boise. This north-south fault and other similar faults have been active in recent times as documented by earthquakes. These faults have exerted, as has been noted in other subsections, strong influence on the course of major streams--in this case the North Fork of the Payette River.

The soils in the basin itself are chiefly alluvial soils with some morainal soils. Surface textures of morainal soils are generally loamy and deep. The alluvial soils are generally fine sandy to fine loamy and some have textural "B" horizons. Many have high water tables with typical blue-grayish-green colors. The West Mountain slopes are chiefly in the Fluvial Granitic Lands landtype association and the soils are generally coarse loamy deep and skeletal in places. About 10 or 15 percent of the area is in Glaciated Headlands and Glaciated Trough Lands and a minor amount of Frost Churned (cryic) Uplands also are in the area. West Mountain soils are somewhat finer textured than other soils in the Forest on similar landtypes due mainly to the influence of the basaltic parent material which caps the highest ridges. These parent materials are mixed with the granitics which outcrop at short distances below the slope.

Much of the valley flora in this unit is dominated by willow and sedges. Some stands of lodgepole pine appear to be in the subalpine fir/dwarf huckleberry habitat type, but the artificial water table created by Cascade Reservoir may have altered the vegetative potential of some of these sites near the reservoir.

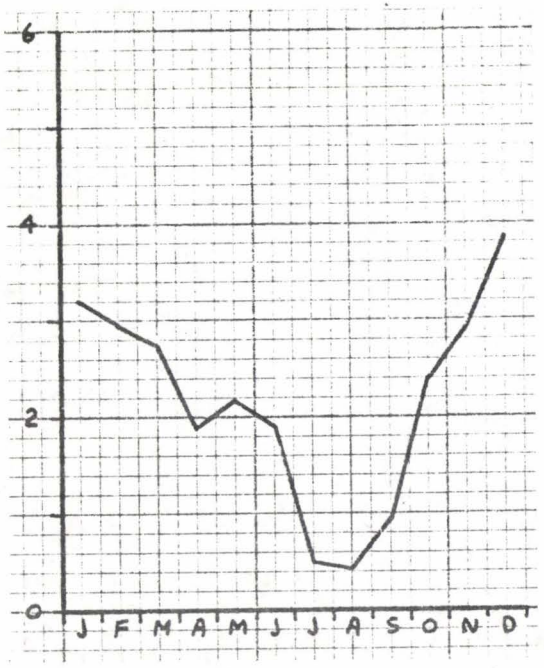
Most sites above the cold air influence on the valley floor support either a Douglas fir/spiraea or grand fir/spiraea habitat type. Sites having greater protection or more moisture support grand fir/tall huckleberry, grand fir/clintonia, or subalpine fir/clintonia. On the upper slopes of the West Mountain, subalpine fir/pinegrass and subalpine fir/whitebark pine are found at the highest elevation.

Average annual precipitation ranges from 30 to 40 inches with an average annual runoff of 10 to 20 inches. Figure 1 shows the range of precipitation of 6- and 24-hour duration storms have at selected intervals of expected occurrence.

Storm Intervals (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.6-2.2	
10	24	2.4-2.8	3.0
25	24	2.8-3.6	
10	6	1.5-1.6	
25	6	1.7-2.0	

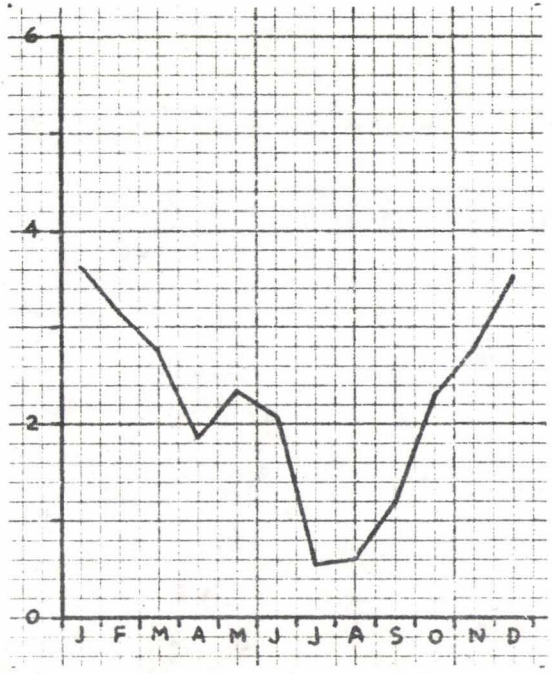
Figures 2, 3, and 4 show the distribution of precipitation by month. Figures 5 and 6 show the snowpack water content in inches for a lower elevation snow course near Crawford and an intermediate elevation snow course at the northern end of the subsection. These figures show the relationship of differences in elevation and some effect of increased moisture because of the rain shadow effect. Figures 7, 8, and 9 show average mean maximum temperatures by month and mean minimum and mean average temperature for three stations in the subsection.

Figure 2



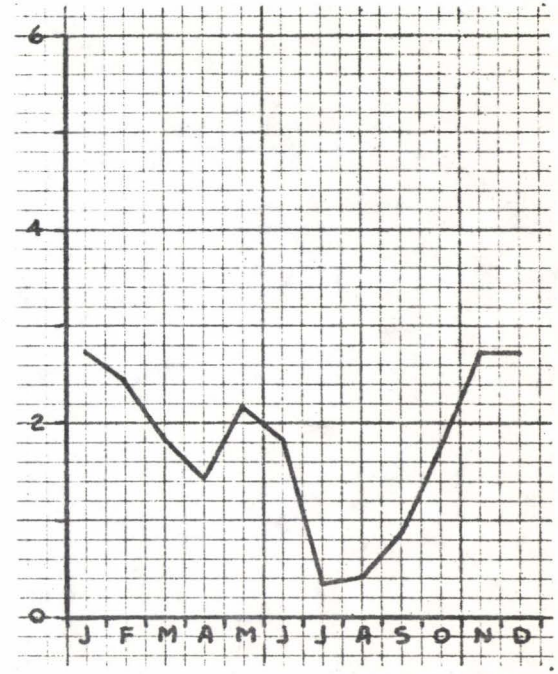
ALPHA 1NE
ELEV. = 4780
YEARS = 22
A.A.P. = 25.89

Figure 3



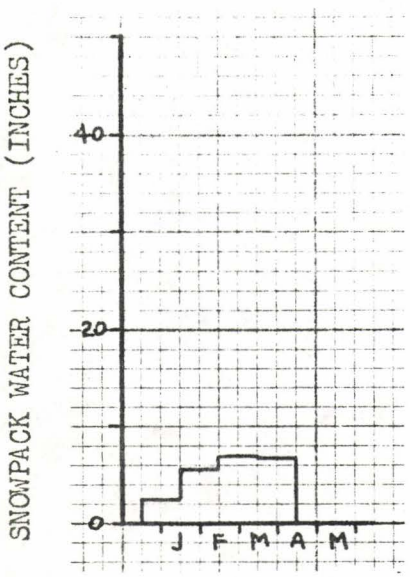
McCALL
ELEV. = 5025
YEARS = 30
A.A.P. = 26.75

Figure 4



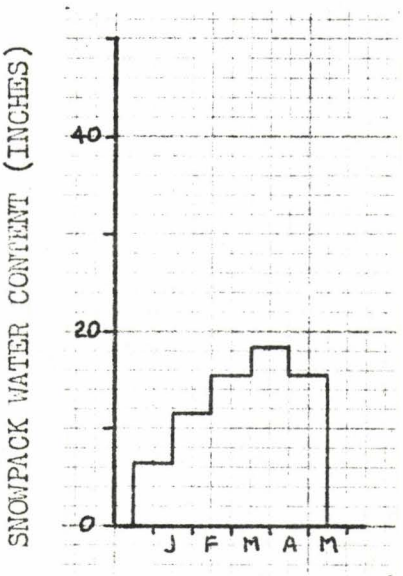
CASCADE 1NW
ELEV. = 4896
YEARS = 19
A.A.P. = 21.29

Figure 5



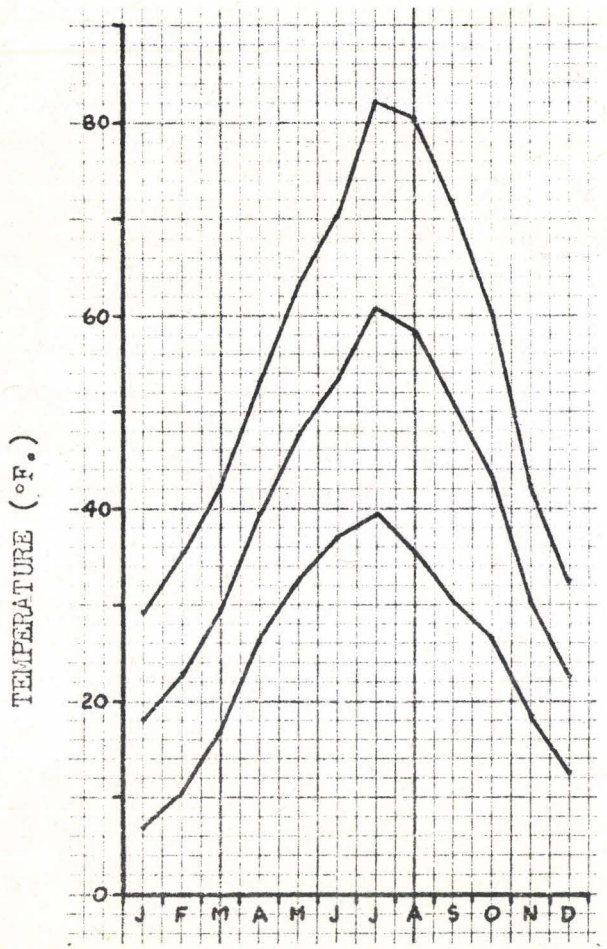
CRAWFORD R.S.
ELEV. = 4800

Figure 6



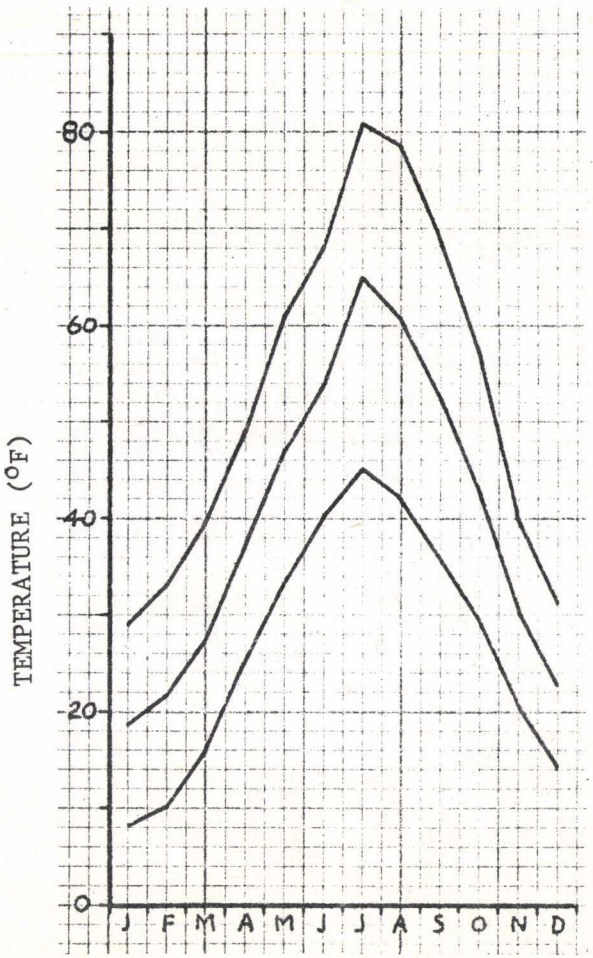
ROCK FLAT SUMMIT
ELEV. = 5200

Figure 7



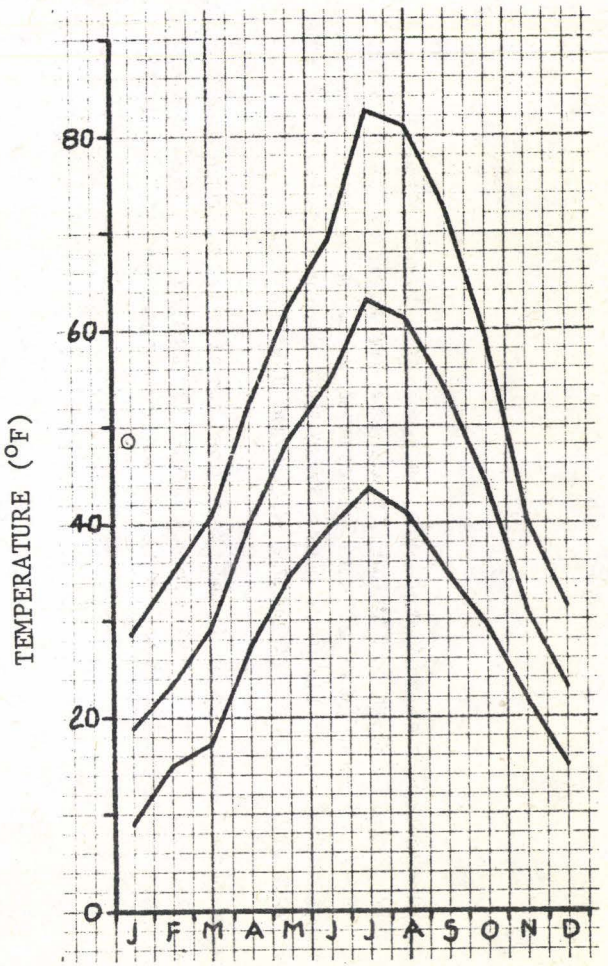
ALPHA 1NE
ELEV. = 4780
YEARS = 23
55.3-39.9-24.4

Figure 8



McCALL
ELEV. = 5025
YEARS = 30
53.1-39.9-26.7

Figure 9



CASCADE 1NW
ELEV. = 4896
YEARS = 19
54.5-40.8-27.1

Forest Service ownership does not include much of the basin itself except around the edges. Most of these lands are moraine or alluvial outwash lands. Most of the fluvial and glaciated slopes on West Mountain, however, are National Forest lands. West Mountain Slope has some of the most highly productive timber producing sites on the Forest.

The challenge to management here is within the constraints composed by the high scenic values and city watershed land in the area. Sedimentation problems are relatively low compared to the rest of the Forest.

Subsection 18 - Long Valley Foothills Subsection

The Long Valley Foothills Subsection occupies about 110,000 acres of the west facing slopes to the east of Long and Round Valleys from the old town site of Alpha to Payette Lakes. More than 85 percent of the unit lies between 5,000 and 7,000 feet with no elevation higher than 8,000 feet. Median elevation is about 6,000 feet and dominant local relief ranges from 500 to 1,000 feet. The unit is maturely dissected with a distinct dendritic drainage pattern. It is drained mainly by westerly flowing Clear Creek, Corral Creek, Big Creek, Beaver Creek and Gold Fork River. Some of the westernmost portions have soft, rolling, low relief which is overlain in places by some of the earlier glacial morainal materials and bedrock is dominantly in weathering classes 5 and 6.

In the interior of the unit, slopes are longer and steeper and more deeply entrenched. Soils in this portion of the unit are generally moderately deep to shallow on southerly slopes and deep to moderately deep on northern slopes. Bedrock in these areas is dominantly in weathering classes 4 and 5.

Basins like those at Paddy Flat and Horsethief are characteristic of the unit. Alluvial soils in these basins are generally very deep, 10-100 feet, with portions of them wet for a good portion of the year.

Some of the upper slopes in the eastern portion of the unit have weakly frost churned (cryic) characteristics with typically weakly entrenched drainages on deep soils.

The geology of this subsection was mapped by Schmidt in 1964. He observed that rocks of the Idaho Batholith graded from gneisses and schists at the western contact with the basalts to migmatites, then quartz diorite gneiss to quartz diorite granodiorite, and finally quartz monzonite eastward. Three of these zones are present in Subsection 18, quartz diorite gneiss in the western part of the subsection, quartz diorite in the northeast trending band that includes Little Valley and granodiorite which underlies most of the eastern portion of the subsection. Schmidt noted several large schist inclusions in the Batholith and these, like the Thompson Peak formation in the Sawtooth, are probably Precambrian belt equivalents.

At the lowest elevations, this unit contains ponderosa pine/bitterbrush on southerly aspects of lateral moraines with many natural wet meadows on the flats. Douglas fir/pinegrass dominates the northerly aspects here as well as upper slopes and ridges at midelevations. A notable exception is the Gold Fork drainage where Douglas fir/elksedge and subalpine fir/elksedge are often more prominent. Small amounts of grand fir/white spiraea, grand fir/blue huckleberry, and grand fir/queencup beadlily occur on moderate sites with deeper soils. This subsection

marks the southern and eastern limits of clintonia and, along with Subsections 21 and 11, the southern and eastern limits of the grand fir series in central Idaho.

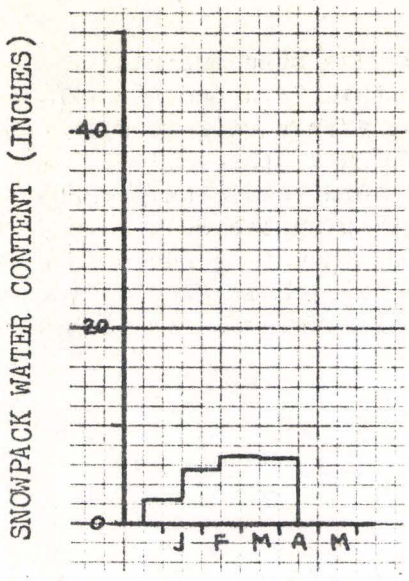
The subalpine fir zone is represented mainly along the northeastern border of this unit. Here subalpine fir/elksedge, subalpine fir/pinegrass, subalpine fir/grouse whortleberry, subalpine fir/beargrass, and subalpine fir/smooth woodrush occur in minor amounts.

Average annual precipitation in this subsection ranges from 30 to 40 inches with an average annual runoff of 15 to 25 inches. Figure 1 shows the range in precipitation from 6- and 24-hour storms from selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	2.0-2.4
10	24	2.8-3.4
25	24	3.4-4.0
10	6	1.5-1.8
25	6	1.8-2.1

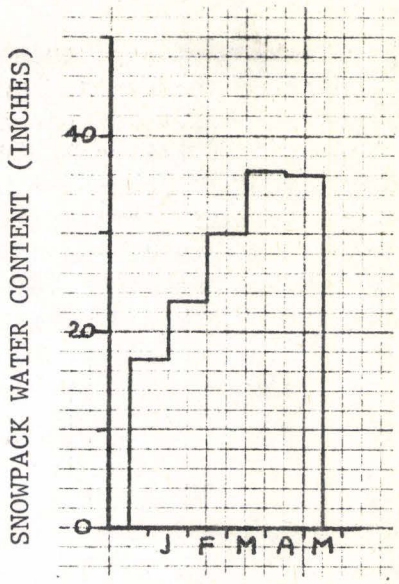
Figures 2, 3, and 4 show the snowpack water content of three stations. Only Lake Fork is actually within the subsection. Big Creek is in the Long Valley Subsection and Big Creek Summit is in the South Fork of the Salmon River Subsection.

Figure 2



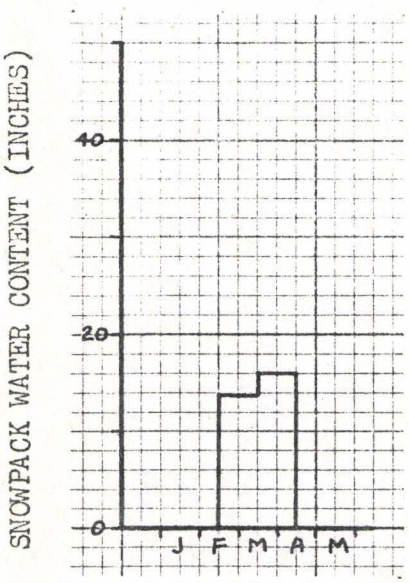
CRAWFORD R.S.
ELEV. = 4800

Figure 3



BIG CREEK SUMMIT
ELEV. = 6600

Figure 4



LAKE FORK
ELEV. = 6000

The challenge to manage these lands has been and will continue to be very sensitive in nature. Much of this land can be seen from Highway 55. The future development of Long Valley will be within easy view for a long period of time of people living in the valley. The importance of tributaries will increase in the future requiring perhaps a higher quality of aquatic environment. Bringing these lands under management within the constraints identified by competing resource use will require careful management and accurate evaluation of true social costs of the varying alternatives as these lands are high sediment producers.

Looking north into Upper South Fork Salmon Subsection 19.

Subsection 19 - Upper South Fork Salmon River Subsection

The Upper South Fork Salmon River Subsection occupies about 150,000 acres of the headlands of the South Fork of the Salmon River and a portion of the uplands which drain westward into the North Fork of the Payette River. Almost all the area lies between 5,000 and 8,000 feet. Median elevation is about 6,800 feet and dominant local relief ranges from 1,000 to 1,500 feet. The central portion is occupied by Warm Lake Basin itself, which lies at about 5,400 feet. The basin is adjoined on the east and west by ridge systems associated with the faulting activities associated with the formation of the basin. Some of the 7,000 to 8,000 feet land surfaces on the eastern ridge system have strong tilted block fault characteristics. It is drained mainly by Dollar, Six-bit, Trail, and Curtis Creeks on the west and Mormon, Bear, Lodgepole, Warm Lake, and Cabin Creeks on the east. These drainages have weak to moderate alpine glaciated characteristics and classic lateral moraines extend into the basin. The moraine from Cabin Creek forms a natural dam for Warm Lake.

The uplands at 7,000 to 8,000 feet have frost churned (cryic) characteristics with typically deep to moderately deep soils with fine sandy loam surfaces and loamy sand subsoils and smooth to weakly dissected slopes. However, the cryic soils tend to be shallow at similar positions at the head of Dollar Creek.

The unglaciated fluvial lands occupy the slope surrounding the basin at elevations between 5,500 and 7,000 feet. These slopes are well dissected and generally have moderately deep to shallow sandy to coarse loamy soils. Bedrock under these soils ranges dominantly from weathering classes 4 and 5 but weathering class 6 is not rare, and weathering class 7 is always an inclusion. The glaciated portions show the typical characteristics of rock weathering classes 2 and 3, with weathering class 4 common. These soils are generally sandy, shallow to moderately deep, stony (skeletal) soils. Schmidt identifies most of the bedrock in this area in the quartz monzonite zone. Examination of the linear maps for Baker and Challis AMS sheets shows that fewer linears are noted in this area as compared to subsections farther east. However, the South Fork itself, in the canyon, followed a very strong north-south fault area. It was also interesting to note that the dominant jointing plains on the north facing and the south facing slopes of the tributaries which run into the South Fork are roughly 90° to each other. This would indicate that the streams are probably fault related. Dominant joining plains want to be generally parallel to the slopes of south facing slopes and perpendicular to the slopes on the north facing slopes.

This unit contains a broad flat valley which accumulates considerable cold air throughout the year. The only lodgepole pine habitat so far identified, lodgepole pine/Idaho fescue, occurs on the driest portions

of the valley floor. With increasing moisture, subalpine fir/dwarf huckleberry quickly becomes a prominent type. Both the wet/bluejoint and dry/dwarf huckleberry phase occur here in response to depth of the water table. Marsh communities occupy the wettest terrestrial sites and lake margins.

Douglas fir/pinegrass and subalpine fir/pinegrass occupy many of the upland areas with lesser amounts of subalpine fir/blue huckleberry on protected sites and subalpine fir/dwarf huckleberry on upper slopes and ridges. Small amounts of grand fir occur here in the subalpine fir/blue huckleberry habitat type but it is not known east of this subsection.

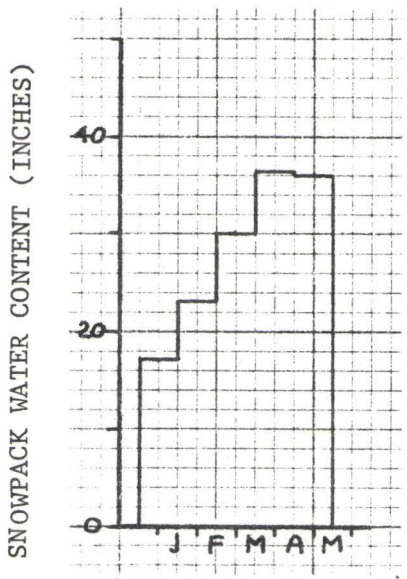
Average annual precipitation ranges from 35 to 45 inches with an average annual runoff of 10 to 20 inches. Figure 1 shows the range of precipitated inches for 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	2.0-2.4	
10	24	2.8-3.4	
25	24	3.4-4.0	
10	6	1.6-1.8	
25	6	1.8-2.2	

There are no climatic stations within this subsection. Reference to Subsection 19 and Subsection 15 gives a feel for the character of the distribution of precipitation and snowpack. This area generally is snow covered from anytime between October through April 1, with remnant snowpack existing past July 4 in the upper elevations in places.

Figure 2 shows the snowpack water content for Big Creek Summit at 6,600 feet which is the only snow course within the area.

Figure 2



BIG CREEK SUMMIT
ELEV. = 6600

The challenge to management of timbered lands within the upper South Fork Salmon River is mostly related to the protection of the spawning and rearing habitats of important salmon and steelhead runs. Concentrated use by people of the Warm Lake recreation complex is another important resource which needs to be considered in utilization of other resources like timber. The opportunity to learn from the well documented curing process of the heavy sediment of the upper South Fork of the Salmon offers a unique opportunity to the Forest Service in documenting and monitoring not only the curing process but in monitoring in more quantitative terms effects of future management activities.

Looking north across Fitsum Peak Subsection (20).

Subsection 20 - Fitsum Peak Glaciated Lands Subsection

The Fitsum Peak Glaciated Lands Subsection is approximately 175,000 acres comprising the steep alpine glaciated ridge system to the west and south of Payette Lakes. The east slopes drain into the Secesh on the South Fork of the Salmon River. The west slopes drain into the North Fork of the Payette River. Almost all the area lies above 5,000 feet. Seventy percent of it is above 7,000 feet. The Sawtooth Ridge system in the central portion is mostly above 8,500 feet. Dominant relief ranges from 2,000 to 3,000 feet.

Bedrock is almost entirely granitic except for a few dikes or more intermediate prophyries.

According to Larson and Schmidt's roadlog of the northern part of the subsection, there is a western zone of quartz diorite (border zone of the Batholith) which grades into coarse quartz monzonite and finally into fine quartz monzonite in the eastern part of the subsection. This is the same pattern of rock type distribution as is generally observed near the western edge of the Batholith, as has already been noted in Subsections 18 and 19 south of Fitsum Peak Glaciated Lands Subsection and in the Burgdorf Basin Subsection of the Salmon Uplands Section immediately adjacent to the north.

About 80 percent of the area is in the Strongly Glaciated Granitic Lands and Granitic Trough Lands landtype associations. About 15 percent of the area is in the Frost Churned (cryic) Uplands and Rejuvenated Cryoplanated Mountain Slope Lands landtype associations. Most of the rest of the area is in Depositional Lands association. Soils in the glaciated associations have widely variable depth but are dominantly sandy and stony. Soils in the frost churned areas are moderately deep to deep, sandy and skeletal (stony in places). Next to the Sawtooth Mountains Subsection this subsection is the most extensive area of alpine glaciated mountains in the Southern Batholith Section. Much of it has been identified as a candidate Wilderness Area. This unit has endured considerable glacial scouring that exposed a granitic rock surface over much of the area at the highest elevation. Consequently for this area the alpine fir/whitebark pine zone perhaps best describes this unit at upper elevations. In the nontimbered situations at these highest elevations communities first identified in similar situations in the Sawtooth have been recognized.

Where adequate soil remains, subalpine fir/beargrass is the dominant habitat type with small amounts of subalpine fir/smooth woodrush near persistent snowpacks. On some sites with high water tables, subalpine fir/western labrador tea and Phyllodoce/Ledum communities are common. On other sites quaking aspen communities are found, especially on talus slides.

At mid-to-lower elevations grand fir/tall huckleberry and some subalpine fir/tall huckleberry often occur on mesic aspects, while Douglas fir/ninebark is common on slightly drier sites.

This area constitutes a zone of high average annual runoff with 35 to 45 or 50 inches of precipitation and the runoff ranging from 10 to 40 with 40 inches per annum probably averaging somewhere near 30 inches. The following figure 1 shows the range of precipitation in inches for 6- and 24-hour duration storms for a selected return interval.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.4-2.4
10	24	2.2-3.4
25	24	2.6-4.0
10	6	1.4-1.6
25	6	1.7-2.2

The challenge to managing these lands lies in protecting the high wilderness values in the central core of the area and identifying those areas on the fringes which could permit more traditional use activities within the constraints required by the high value anadromous fishery.

Subsection 21 - Upper South Fork Salmon River Canyonland Subsection

The Upper South Fork Salmon River Canyonland Subsection is an area of about 55,000 acres, comprising the rejuvenated canyonlands from the confluence of the East Fork of the South Fork of the Salmon and on the South Fork of the Salmon south to Warm Lake Basin and east to Stibnite. Elevations range from about 4,000 to 7,500 feet. Median elevation is about 6,000 feet and dominant local relief ranges from 2,000 to 3,000 feet. This subsection is actually an extension of the Salmon River Canyonlands Subsection from the Salmon Uplands Section into the Southern Batholith Section.

The depth of entrenchment appears to indicate the rivers have been able to maintain themselves in these canyons almost since the erosional process started after uplift and that they probably follow a general fault zone.

None of the slopes shows evidence of glaciation but some of the upper and north facing slopes have frost churned (cryic) characteristics. Some of the slopes are true river breaks with typical truncated facets directly above the river having 1 and 2 order drainages directly entering 6 and 7 order streams.

The granitic bedrock is characteristically more competent in the entrenched canyon bottoms. Larson and Schmidt (1958) classified the entire area as coarse quartz monzonite, but bedrock is almost entirely granitic except near Stibnite where rock of the belt series and undifferentiated sedimentary rocks appear.

Other slopes range from strongly to moderately dissected fluvial slopes. Soils are dominantly coarse textured and moderately deep but shallow soils and rock outcrops are common on the steeper slopes. Soils are dominantly sandy loams to loamy sands and extremely stony in places, particularly on the river breaks.

Douglas fir/ninebark dominates much of the area especially on northerly aspects with spruce fir/white spiraea and some Douglas fir/snowberry on the warmer sites. On river terraces, arctostaphylos forms a conspicuous layer with snowberry and indicates the Douglas fir/snowberry - Kinnikinnick phase. On other terraces and benchlands ponderosa pine/bitterbrush becomes abundant at the lower elevations. On moist protected slopes, small pockets of grand fir/queencup beadlily are commonly surrounded by larger areas of grand fir/blue huckleberry. On steep southerly slopes and ridges some ponderosa pine/Idaho fescue and ponderosa pine/bluebunch wheatgrass are common at the lower elevations.

Average annual precipitation is about 25 inches and runoff about 10 inches. The following shows the range of precipitation for 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.4-1.8
10	24	2.0-2.4
25	24	2.6-3.0
10	6	1.3-1.5
25	6	1.6-1.7

The chief challenge to management in this subsection is mainly in the protection of the high value anadromous fishery immediately adjacent to this subsection. The chief limiting constraint is to bringing not only the lands within the subsection under management, but also with the crossing lands within this subsection to gain access to lands in adjacent subsections. The sediment produced from the development access is generally extremely high. There are only limited areas within the subsection where building access roads across lands of this subsection would be accomplished within safe limits and still meet the primary management objective of protecting the anadromous fishery values.

Subsection 22 - Upper Middle Fork Salmon Streamcut and Canyonlands Subsection

The Upper Middle Fork Streamcut and Canyonlands Subsection is an area of about 3/4 million acres comprising the extremely dissected granitic mountain lands of the Upper Middle Fork of the Salmon River. It lies between the Landmark-Bear Valley Basin and Upland Subsection on the west and the more complex geology of the Challis Section on the east.

The Middle Fork of the Salmon River and some of its tributaries are entrenched about 4,000 feet. Elevations range from 4,200 to over 10,000 feet. Median elevation is about 7,500 feet and dominant local relief ranges from 2,500 to 3,000 feet.

About 15 percent of the unit is Canyonland Landtype association: extremely steep slopes, shallow snowpacks, low annual precipitation, high temperatures, 1 to 5 inches water yield, sparsely vegetated with brush and grass, shallow granitic soils, very high sediment production, and important big-game winter range.

About 50 percent of the area is comprised of steep granitic fluvial lands with very steep and rugged terrain and moderate snow packs. Annual precipitation is 15-30 inches, water yield is about 5-15 inches. Vegetation is mixed conifer and brush and grass; predominantly high stability hazards and moderately low productivity. At elevations of 7,000 to 8,000 feet in this unit slopes and uplands have frost churned (cryic) characteristics.

About 35 percent of the area is strongly glaciated (mainly on the west and south portion of the area). These areas have deep long-lasting snow packs, 30 to 55 inches precipitation and 20 to 30 inches water yield, low productivity for essentially subalpine fir habitat types, very short growing season, and important big-game summer range. Elevations are mainly from 7,500 to 9,000 feet.

On some of the driest aspects, bluebunch wheatgrass or sandberg bluegrass and bluebunch wheatgrass/Idaho fescue occupy the warmer and cooler aspects respectively. In some areas these communities may interfinger with small amounts of bitterbrush/subalpine big sagebrush and ponderosa pine/bitterbrush associations. All of these dry communities merge quickly into Douglas fir/spiraea or Douglas fir/elksedge habitat types with a slight increase in moisture. Much of the Douglas fir/spiraea habitat type is the pinegrass phase which at slightly higher elevations merges with extensive Douglas fir and subalpine fir/pinegrass habitat types. At the upper elevations subalpine fir/grouse whortleberry occurs on the more mesic sites with subalpine fir/elksedge on drier south slopes. The uppermost slopes and ridges support a whitebark pine subalpine fir community, much of which has an Idaho fescue understory.

This area contains several cirque basins and valleys which support various amounts of subalpine fir/western ledum, subalpine fir/bluejoint reedgrass, and subalpine fir/marsh marigold. Some subalpine fir/dwarf huckleberry also occurs here where cold air accumulations create frost pocket conditions.

The following figure shows the range of precipitation in inches for 6- and 24-hour storms which have selected return interval storms.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.4-1.8	2.0
10	24	2.4-2.8	3.0
25	24	2.6-3.0	2.4-3.4
10	6	1.2-1.5	1.6
25	6	1.5-1.7	

The problems associated with managing the lands in this subsection will generally lie in gaining access to resources identified in the area. Road building in these landscapes is going to be extremely difficult, costly, and with high sediment potential. It is a rather severe ecosystem with short growing seasons and dry summers and relatively moderate low to productive soils. Much of it already is in the proposed Wilderness Area.

Profile-Monumental Subsection 23.

Subsection 23 - Profile - Monumental Subsection

The Profile - Monumental Subsection is an area of about 725,000 acres lying in the strongly rejuvenated lands in the mixed bedrock area of the Big Creek drainage and the Upper East Fork of the South Fork of the Salmon and Indian Creek and Marble Creek drainages.

The central portion of the unit consists of steep volcanic Fluvial Lands. These lands are extremely steep and rugged, with moderate to deep snowpacks, annual precipitation of 20 to 50 inches and water yields of 5 to 20 inches, vegetative potential is dominantly low to moderate, variable watershed and stability conditions.

Soils in the area have sandy loam or loam textures throughout. Surfaces are generally dark colored and stony. These soils usually have high volumes of angular coarse fragments throughout the profile and textural "B" horizons are common. Depths vary with aspect, slope, and slope position but range from 16 to 40 inches or more. The volcanic bedrock is dominantly fairly hard and well fractured.

About 45 percent of the area (between 7,500 to 9,000 feet) has been strongly glaciated. The glaciated portion on the west is largely in granitics and in volcanics elsewhere. Soils in this portion are typically light colored, coarse textured, and contain high volumes of angular coarse fragments. Textures range from sand to sandy loam in the subsoil and loamy sand or sandy loam in the surface. Soil depths are highly variable. These areas have deep, long-lasting snowpacks, annual precipitation of 30 to 60 inches and water yields of 20 to 30 inches, very low vegetative productivity, good watershed condition, high scenic values, and important bighorn sheep and mountain goat summer range areas. Frost churned slopes are common in this unit.

About 15 percent of the area (mainly along the northern boundary of the unit between 5,000 and 6,500 feet) is composed of steep granitic Fluvial Lands having very steep rugged topography, moderate to heavy snow packs, annual precipitation of 15 to 40 inches and water yield of 5-20 inches, predominantly good watershed conditions with dominantly Douglas fir habitat types, predominantly high stability hazards, and moderate productivity.

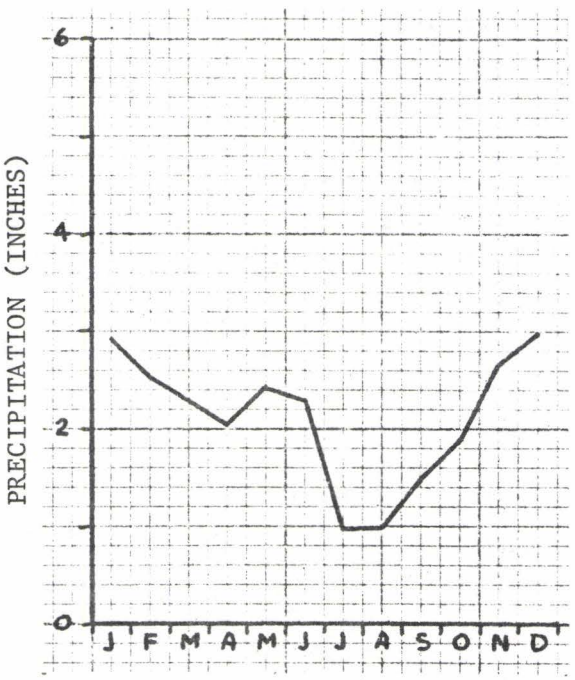
Small amounts of bluebunch wheatgrass/Poa and bluebunch wheatgrass/Idaho fescue occur on southerly aspects at the lowest elevations in this unit. Some ponderosa pine/bitterbrush also occurs along lower slopes and benches. Douglas fir/pinegrass with lesser amounts of Douglas fir/white spiraea dominate major portions of the Douglas fir zone. Douglas fir/ninebark and Douglas fir/snowberry are frequent on more mesic lower slopes and benches. At upper elevations, subalpine fir/beargrass is the major habitat type with lesser amounts of subalpine fir/grouse whortleberry in some areas. Within the whitebark pine and subalpine fir zone,

minor inclusions of the subalpine fir/smooth woodrush habitat type can be found on northerly aspects having persistent snow cover.

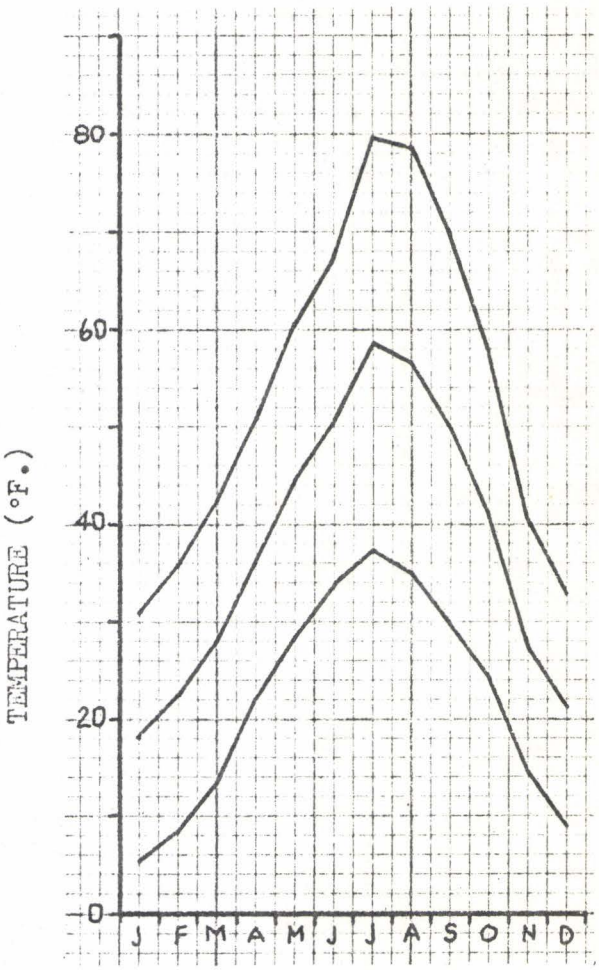
Figure 1 shows the range of precipitation of 6- and 24-hour storm that recurred at selected intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.4-2.0	
10	24	2.0-2.8	
25	24	2.4-3.2	
10	6	1.3-1.6	1.2
25	6	1.4-1.8	

Figure 2 shows the distribution of precipitation at Big Creek, elevation 5,680. Figure 3 shows the mean maximum-minimum and average temperature by month. Most of this subsection lies in the proposed Wilderness Area and the associated management problems are pretty well identified in the analysis of the Wilderness Area proposal.



BIG CREEK
ELEV. = 5680
YEARS = 21
A.A.P. = 25.54



BIG CREEK
ELEV. = 5680
YEARS = 23
54.0-37.9-21.8

Section II - Challis Section

This section is an elongated area of about 3,100 square miles extending roughly from Hailey to Salmon, Idaho, a distance of about 135 miles. The area is about 40 miles wide in the Ketchum area and about 5 miles wide near Salmon (roughly between 43° 15' and 45° N latitude and 113° 55' and 114' 45° W longitude).

It is bounded on the west by the Southern Batholith Section except in the northern portion where the Salmon Mountains are bounded on the west by the Salmon Uplands Section. The section is bounded on the east by the Open Northern Rockies Section.

The area contains the Boulder-Pioneer-White Clouds, Smokey, and Salmon Mountain Ranges. The wide portion to the south is drained mainly by the Big Wood, East Fork of the Salmon and the headwaters of the Big Lost River. On the north it is drained by a series of fourth-order streams which drain the east slope of the Salmon River Mountains directly into the Main Salmon River. It ranges in elevation from about 4,000 feet to over 11,500 feet. The median elevation is about 7,400 feet.

It is composed of seven subsections (Table 11). It contains relatively minor amounts of granitic rocks, and is dominated by an extensive Palezoic section, large masses of Tertiary Volcanics and some Precambrian rocks (Table 12).

Table 11

The Challis has been separated into seven subsections as follows:

Map Symbol	Section Name	Range in Elevation	Dominant Local Relief	Median Elevation
1.	Bellevue Foothills Subsection	5000-7600	100/500-1500	6000
2.	(W 2/3) Ketchum Subsection	5300-10300	1500-2500	7500
2.	(E 1/3) Ketchum Subsection			6500
3.	Boulder-Pioneer Subsection	6000-11700	2000-3000	8000
4.	White Clouds Subsection	7500-11800	1500-2500	8800
5.	East Fork Salmon River Subsection	5300-9700	1500-2500	7500
6.	(N 2/3) Challis Subsection	4400-10300	1500-2500	6500
6.	(S 1/3) Challis Subsection			7500
7.	Salmon Mountain Subsection	3800-9300	800-1600	5500

Table 12

Bedrock	Dominant Soil Textures*
Paleozoic	
Phyllites	Dominant soil textures loams/loam and heavy silt loams
Dolomites	Silt loams/heavy silt loams
Argillaceous (siliceous (calcareous	Sandy loams/loams
Slates	Silt loams
Conglomerates	Loams
Quartzites	Loamy sands to sandy loams
Limestone	Silt loams/clay loams
Sandstone (siliceous (calcareous	Sandy loams/sand clay loams
Tertiary Volcanics - (Challis Volcanics)	Loams/heavy loams Loams/clay loams
Latite-Andesite Flows (purple to lavender to brownish)	
Basalt (browns to dark grayish)	Loams/clay loams
Tuffs (buff colored)	Silt loams/silty clay loams
Welded Tuffs	Sandy loams
Rhyolite	Sandy loams
Precambrian Rocks - Mainly quartzites	

* Surface/subsoils; where no slash (/) is given, textures are relatively similar throughout profile.

Table 12 also shows the kinds of soil textures that can be expected of surface soils and textural B horizons when they are present. Most soils derived from resistant rock like quartzite, sandstone, welded tuffs, basalt, etc., are stony as well. Soil depths vary, of course, with position on slope, steepness, and dissection.

Low total precipitation and bedrock geology are the dominant factors influencing the character of the vegetation in this section. The Challis Subsection portion of the area lies in the rain shadow of the central Idaho mountains which contributes to the reduced precipitation received during the winter months. The summer growing season is characterized by prolonged periods of low humidity under cloudless skies.

The bedrock geology of the section is largely volcanic and sedimentary in origin. This geology produces soil and hydrologic characteristics that are a marked contrast to those of the granitic section to the west. Slowly permeable soils produce higher surface runoff and consequently higher suspended sediments, compared to the rapid infiltration of granitic soil.

Many of the habitat types found in the Idaho Batholith are not present in this section. If they occur at all, important species such as ponderosa pine, ninebark, grand fir, and mountain maple are present only as isolated remnants.

The dominant forest series in the northern part of the section are Douglas fir and subalpine fir. Characteristic habitat types include the Douglas fir/spiraea-pinegrass, Douglas fir/Idaho fescue, subalpine fir/arnica and subalpine fir/grouse whortleberry. In the southern part of the section, the characteristic habitat types include Douglas fir/mountain snowberry, Douglas fir/pinegrass, Douglas fir/elksedge, Douglas fir/arnica, subalpine fir/elksedge and subalpine fir/arnica.

The dominant nontimbered habitat types in the section include mountain big sagebrush/Idaho fescue, mountain big sagebrush/bluebunch wheatgrass, and mountain big sagebrush/mountain snowberry.

Mountain big sagebrush/mountain brush are characteristic of the Wood River sediments in the southern part of the section.

The whitebark pine barren zone occupies the highest elevations throughout this section.

Average annual precipitation within the section ranges from less than 10 to over 45 inches. The average annual precipitation for the entire section is a comparatively low 21.30 area-inches.

Three main factors contribute to relatively reduced precipitation: (1) The high mountain barriers to the west tend to intercept a considerable portion of the winter cyclonic precipitation before it has an opportunity

to reach the section. (2) Because of the section's southeastern position within the Batholith, it tends to receive only the tail-end of a normal winter cyclonic storm. (The frequency and magnitude of winter cyclonic storms tend to decrease from north to south.) (3) The generally eastern aspect of the north and central portions of the section is conducive to a rain shadow effect because the general winter air mass movement is from west to east.

The Challis Section has a dry winter and wet summer climate in the northern and central portions. The southern portion tends to have two wet-dry cycles. Precipitation stations at Salmon, Chilly Barton Flat, and Challis are characterized by long-term records of 8.93, 8.08, and 6.93 inches of precipitation annually. Highest monthly precipitation totals are limited to May and June for these stations. The remaining 10 months are characteristically dry with monthly precipitation totals typically less than 1 inch. Precipitation stations within or near the southern portion of the section exhibit two wet seasons, October through March and May-June. The first tends to have higher monthly totals than the latter.

The difference in annual wet-dry cycles result from the character and timing of storms passing through the section. Two basic storm seasons occur within the Idaho Batholith: (1) Low altitude cyclonic storms originating from the Pacific Ocean and traveling easterly account for most of the winter precipitation (November through March). The northern and central portions of the Challis Section do not receive the full benefit of this type of storm for reasons as discussed earlier. The southern portion receives more due to its higher elevations. This first storm season, then, accounts for basically no wet season in the upper portion of the section and one wet season for the lower southern portion. (2) High-altitude storms originating in the Gulf of Mexico and traveling northerly account for spring-early summer (May and June) precipitation for both portions of the section.

Valley precipitation shows a marked decrease from adjacent higher elevation topography. Analysis of the isohyetal map reveals that the main Salmon River and Big Wood River valleys receive as little as 10 to 15 inches per year.

As with most snow course data, April 1 surveys generally record highest winter water content. April 1 snowpacks contain approximately 60 percent of the total annual precipitation. May 1 surveys are not far behind with approximately 50 percent of the total annual precipitation. The stations are about 7,000 feet elevation.

The average annual maximum, mean, and minimum air temperatures for this section at median elevation are 49.9°F., 33.9°F., and 18.0°F., respectively. The maximum-minimum variation is 31.9°F. The main reason for

the relatively cool temperatures is the high median elevation (7,400 feet). The reduced influence of the Pacific Ocean maritime influence is the prime reason for the relatively high maximum-minimum variation. The elevational relief within the section is about 8,000 feet. This range in elevation can account for a 28°F. temperature difference from the lowest and highest areas of the section at any one time.

Growing seasons within the Salmon River valley vary from about 100 to 120 days between Salmon and Challis to less than 10 days within the highest upstream areas. The Big Wood River valley growing season is 70 to 90 days in the lower areas and less than 10 days in the highest portions of the drainage.

The average annual runoff from the section is 7.55 area-inches or 1,248,000 acre-feet. This is equivalent to 35.4 percent of the average annual precipitation.

Evapotranspiration accounts for 13.75 area-inches (2,273,000 acre-feet) of water loss annually. This is slightly less than 65 percent of the average annual precipitation.

In general, climatic limitations tend to place this section in moderately low to low productivity classes for the growing of trees and generally only moderate for growing forage. This section has some high value wilderness-type areas (White Clouds-Boulder-Pioneer Areas) as well as some highly mineralized areas. Streams have generally high productive potentials for native species and the Salmon River is an important salmon and steelhead spawning and rearing habitat.

Subsection 1 - Bellevue Foothills Subsection

The Bellevue Foothills Subsection is an area of about 1/4 million acres occupying the foothills area east of Soldier Mountain across the Wood River valley to Fish Creek and south of the Smokey and Pioneer Mountains and north of the Snake River plain. About 80 percent of the area lies between elevations of 5,000 and 6,000 feet. The rest of the area lies below 7,200 feet. Less than 10 percent of the area lies within National Forest boundaries.

As the name suggests, this subsection consists of soft rolling uplands with dominantly low rolling relief (mostly 800 feet or less but ranges from 100-1,500 feet) with well developed dendritic stream patterns. Ridges and drainageways (valleys) are usually softly rounded. None of the area shows evidence of past glaciation or periglaciation, and most of the landtypes fall in the Weakly to Moderately Dissected Fluvial Landtype associations. Less than 10 percent of the area is in the Depositional Landtypes.

Challis volcanics (mostly basalts) and Paleozoic (mostly Wood River formation and in a few places Milligen formation) overlie Idaho Batholith granitic rocks. On some slopes the presence of granitics is not discernible, whereas on some slopes the granitics are capped by 50 feet or less by Challis volcanic rocks. About one-third of the slopes have been completely stripped of other rocks exposing granitic rock outcrops. The granitic bedrock in the area is typically brighter in color than elsewhere in the Batholith. This may be caused by hydrothermal activities and dike intrusions of more basic materials or by its closer contact with other rock types in the area.

Soils on slopes underlain by Wood River formation are generally deep, coarse loamy, and skeletal. Soils underlain by granitic are generally moderately deep to deep, sandy and in some places xeric. Soils underlain by Challis volcanic are commonly moderately deep, loamy to fine loamy, and in some places xeric and/or skeletal. The fine textured soils are miry and slick when wet and produce turbid stream flows from open disturbed slopes. The soils derived from Wood River sediments are high in coarse fragments (angular gravel) and water infiltrates rapidly through the soil and into fractured bedrock. These soils and slopes have a stable but slow rocky creep mantle. Some old slumps occur on Challis volcanic soils and these are usually occupied by aspen.

The higher elevations are dominated by mountain big sagebrush/mountain brush on sedimentary soils and mountain big sagebrush/mountain snowberry on Challis volcanic soils. These types grade into mountain big sagebrush/Idaho fescue and mountain big sagebrush/bluebunch wheatgrass at lower elevations. Pockets of aspen/mountain snowberry occur in suitable habitats throughout, largely associated with moist sites. On north

slopes Douglas fir/mountain snowberry occurs with minor amounts of Douglas fir/elksedge and Douglas fir/pinegrass. Stream bottoms are dominated by a complex of meadow, willow and cottonwood types.

Average annual precipitation in the area ranges from about 15-25 inches with runoff from 1-5 inches.

Figure 1 shows the range in precipitation for 6- and 24-hour duration for several expected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusion(s)
2	24	1.2-1.6	1.8
10	24	2.2-2.6	
25	24	2.4-2.8	
10	6	1.3-1.5	1.1-1.6
25	6	1.5-1.8	

Figures 2 through 7 show the distribution of precipitation and temperatures for Soldier, Fairfield, and Hailey Ranger Stations, respectively. Figures 8 through 10 show the water content of snow packs for Couch Summit, Soldier Ranger Station, and Muldoon. Comparing two close snow courses (Couch Summit with Soldier Ranger Station), shows how significant 850 feet in elevation can be. Comparing Muldoon (figure 10) with Couch Summit (figure 8) and Soldier Ranger Station (figure 9) shows the distinct decreasing precipitation trend eastward. This trend is also supported by comparing figures 2, 3, and 4.

Figure 2

SOLDIER R.S.
ELEV. = 5755
YEARS = 18
A.A.P. = 22.83

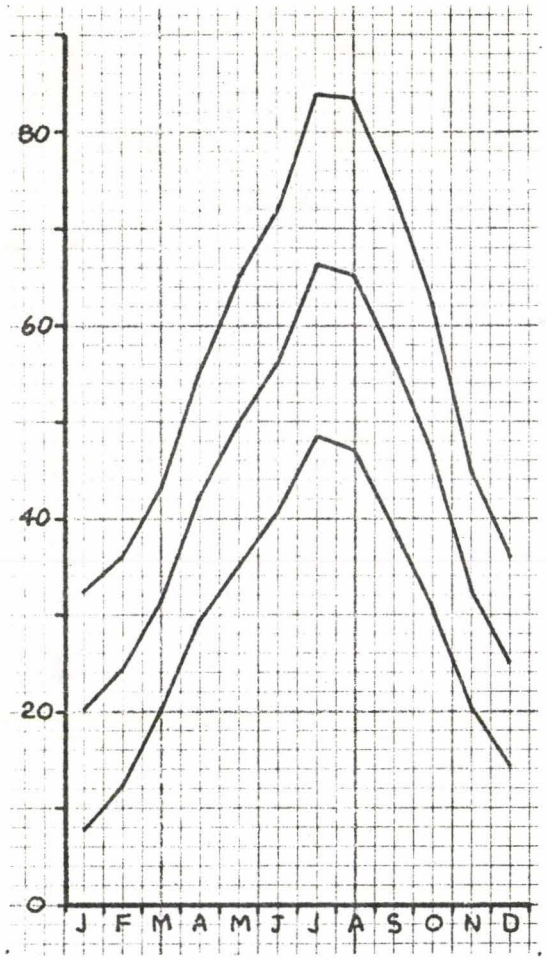
Figure 3

FAIRFIELD R.S.
ELEV. = 5065
YEARS = 13
A.A.P. = 15.64

Figure 4

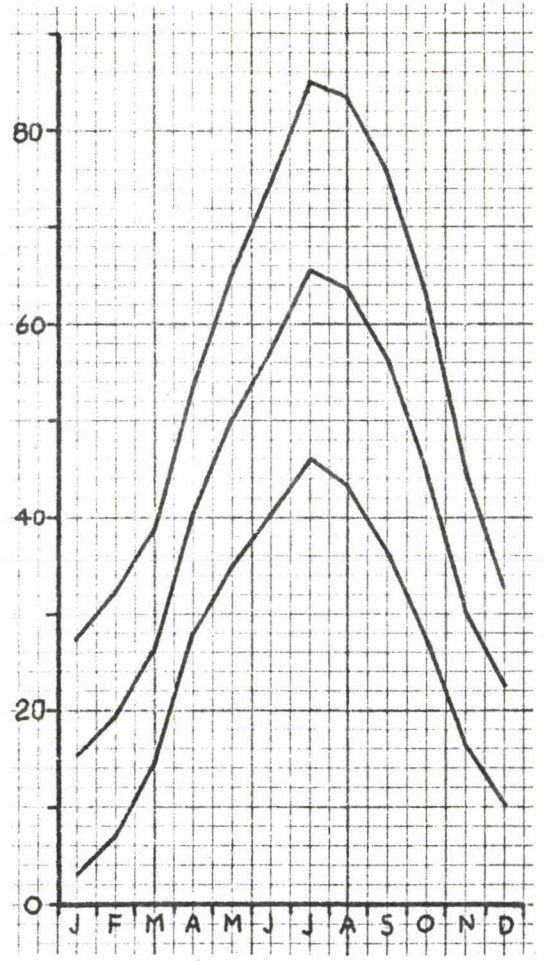
HAILEY R.S.
ELEV. = 5328
YEARS = 30
A.A.P. = 14.53

Figure 5



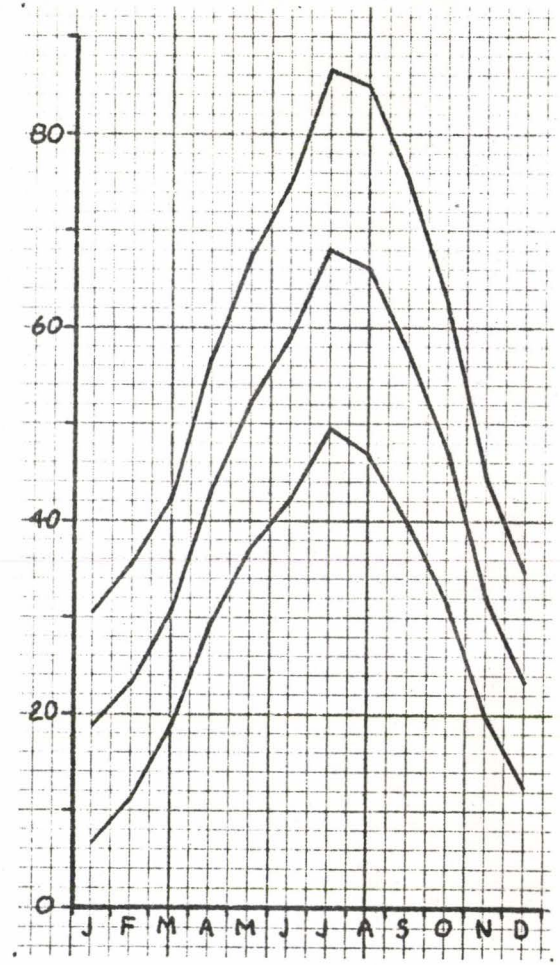
SOLDIER CREEK A.S.
ELEV. = 5755
YEARS = 15
57.3-43.0-28.7

Figure 6



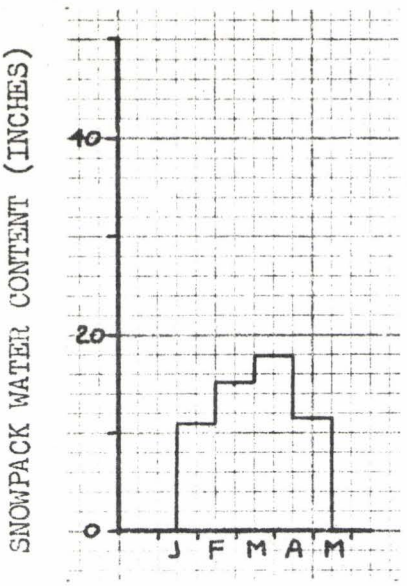
FAIRFIELD R.S.
ELEV. = 5065
YEARS = 13
56.5-41.1-25.7

Figure 7



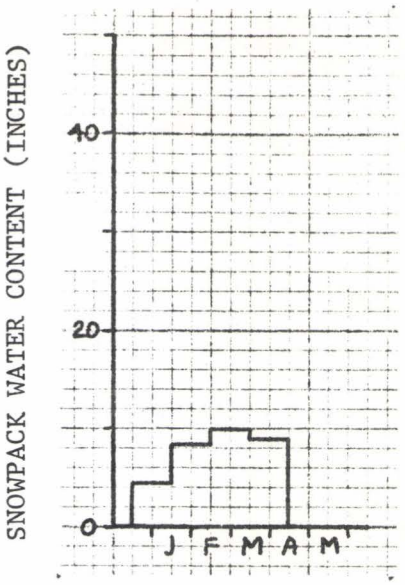
HAILEY R.S.
ELEV. = 5328
YEARS = 30
58.1-43.5-28.9

Figure 8



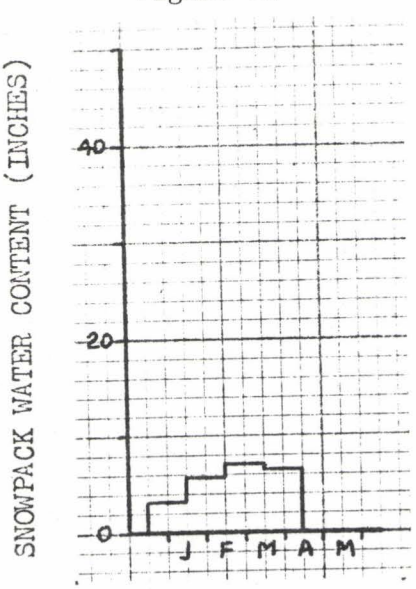
COUCH SUMMIT
ELEV. = 6950

Figure 9



SOLDIER R.S.
ELEV. = 6100

Figure 10



MULDOON
ELEV. = 6300

Looking east across Wood River into typical ridge system of Ketchum Subsection (2).

Subsection 2 - Ketchum Subsection

The Ketchum Subsection is an area of about 1/4 million acres extending northward from Hailey to the Galena Summit area. It is bounded on the east between the confluence of the main branches of Wood River (on the north) to Hailey (on the south) by the low benchy faulted foothills which extend eastward 5-7 miles from the river. Wood River itself is the northern and eastern boundary upstream from the confluence of the main branches of the Wood to the Galena Summit area. The western boundary follows the divide between the Boise and Wood River drainages.

Elevation ranges from about 5,300 feet at Hailey to over 10,000 feet at Norton Peak with about 75 percent of the area between 6,000 and 8,000 feet and about 20 percent of the area over 8,000 feet. Local relief ranges from 1,500 to 2,500 feet.

Except for granitic outcrops along the main ridge of the Smokey Mountains along the western boundary of the subsection, the area is covered by Challis volcanic (northern and eastern 1/2) and Paleozoic rocks (Wood River and Milligen formations). These latter formations have been folded into a broad, broken outline which roughly parallels the Wood River Valley. The emplacement of the Batholith may have been the cause of the many small thrust faults in the area. The four sets of terrace materials which have been identified on the eastern foothills were probably the result of a combination of a number of factors:

1. Damming by basalts of Snake River plain to south.
2. Uplift in subsection-subsidence in Snake River plain.
3. Several periods of glaciation.

Most of the area is comprised of an early mature ridge and valley system having a complete dendritic drainage pattern. The major direction of all major tributaries in the area appears to be structurally controlled. Average relief in the area approaches 2,000 feet. The heads of the drainageways from Dollarhide Summit north, comprising about 15 percent of the area, show moderate expressions of alpine glaciation.

Less than 5 percent of the area is in Depositional Landtype associations. Also, less than 5 percent of the area is in Oversteepened Canyonlands and Headlands associations. About 10 percent of the area is in Smooth to Weakly Dissected Mountain Slope (fluvial and cryic) Landtype association and the remainder is in Moderately to Strongly Dissected Mountain Slope (fluvial) Landtype association. Bedrock (in order of occurrence) is Challis volcanics, granitics, and Paleozoics.

Soils on the Challis volcanics are commonly moderately deep, loamy to fine loamy and in some places xeric and/or skeletal. Granitic soils are generally moderately deep to deep, sandy to coarse loamy and on south slopes xeric. Soils from Paleozoic sediments and metamorphics are generally deep, coarse loamy, skeletal and xeric in places.

The dominant timber habitat type on south slopes on both Challis volcanics and Wood River sediment is the Douglas fir/elksedge. Productivity is somewhat higher and understory diversity somewhat greater on the Wood River sediments. On north slopes on Challis volcanic soils, Douglas fir/arnica and Douglas fir/mountain snowberry predominate. Pockets of Douglas fir/pinegrass and Douglas fir/mountain maple occur on north slopes on sedimentary soils. At higher elevations subalpine fir/elksedge predominates on north slopes on granitics, sedimentary, and volcanic parent materials. Pockets of subalpine fir/mountain maple and subalpine fir/spiraea occur on better soils derived from Wood River sediments. On both these latter types, Douglas fir is often an important seral species and was present on all sites examined. Granitic material predominates at the highest elevations that border the area on the west. Subalpine fir/elksedge is the dominant timber type on these areas.

A few stands of lodgepole pine/Idaho fescue occur on some glacial moraine and glacial outwash terraces.

Aspen/mountain snowberry occurs in pockets up the main Wood River on the east side. Mountain big sagebrush/Idaho fescue and bluebunch wheatgrass, and mountain big sagebrush/mountain snowberry are the predominant vegetation types along the east and north eastern portions of the subsection, particularly on the Challis volcanic soils. On shallow soils and on the river terrace areas thermopola low sagebrush/Idaho fescue occurs.

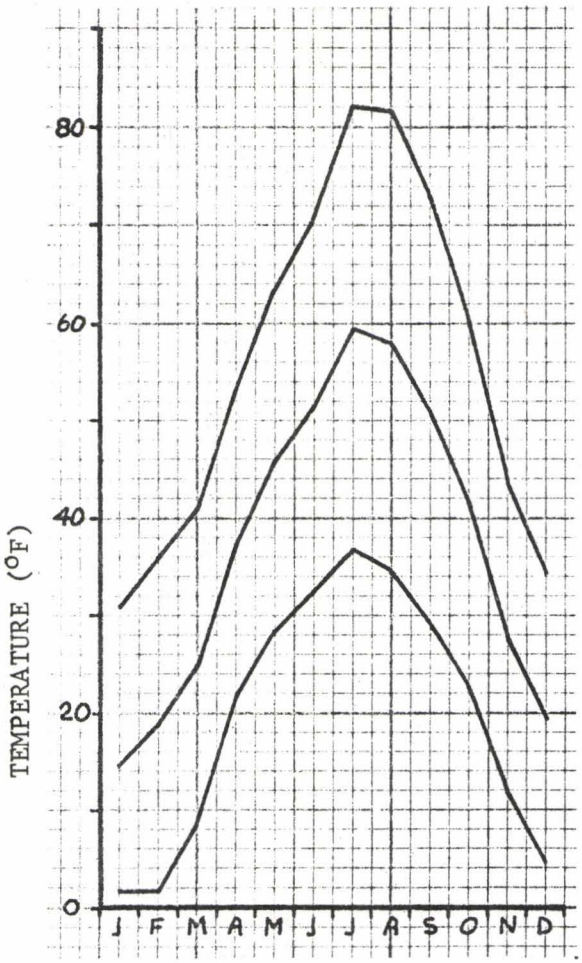
Lodgepole pine is a conspicuous seral timber species occurring both on Douglas fir and subalpine fir types at higher elevation.

Average annual precipitation ranges dominantly from about 15-35 inches with runoff from about 5-20 inches. Figure 1 shows the range in precipitation for 6- and 24-hour duration storms at various selected return intervals (frequency events).

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.4-2.4	
10	24	2.2-3.2	3.4
25	24	2.6-3.8	4.0
10	6	1.2-1.6	
25	6	1.5-2.0	

Figures 2 shows mean maximum, minimum, and average temperatures, and figure 3 shows precipitation distribution at Sun Valley. Figure 4 shows the water content of snow packs at Galena, Galena Summit and Dollarhide.

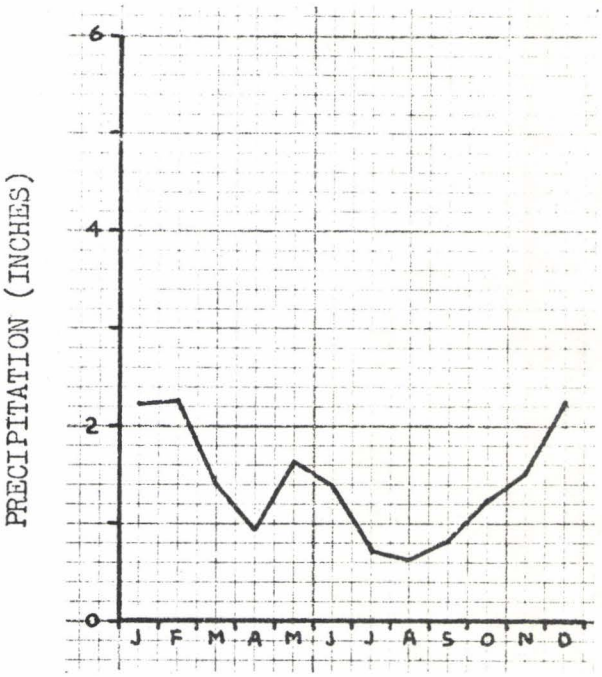
Figure 2



MONTHS

SUN VALLEY
ELEV. = 5821
YEARS = 23
55.9-37.5-19.2

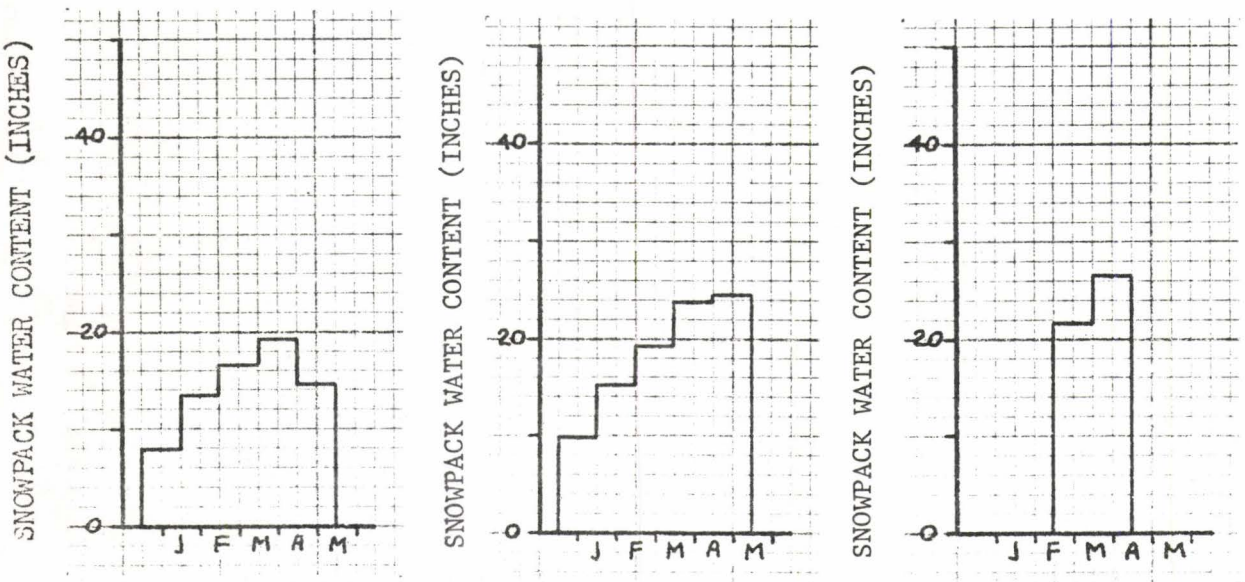
Figure 3



MONTHS

SUN VALLEY
ELEV. = 5821
YEARS = 24
A.A.P. = 17.01

Figure 4


SNOWPACK WATER CONTENT (INCHES)
40
20
0
J F M A M
MONTHS
GALENA
ELEV. = 7300
SNOWPACK WATER CONTENT (INCHES)
40
20
0
J F M A M
MONTHS
GALENA SUMMIT
ELEV. = 8795
SNOWPACK WATER CONTENT (INCHES)
40
20
0
J F M A M
MONTHS
DOLLARHIDE SUMMIT
ELEV. = 8620

The chief challenge to management associated with the Challis volcanic and Wood River formations are as follows:

> Challis volcanics have fine textured soils and higher surface runoff. Activities of disturbance cause a higher turbid sediment. Roads and trails are rutted with traffic on moist soil. In the steep slopes, shallow soils and rock outcrop make access difficult. Overland flows and slumps require heavy type maintenance.
>
> Wood River sediments develop a deep skeletal soil profile with high infiltration. The flows are deep, often to fractured bedrock and often don't surface to a third order drainage. The steep slopes, however, have a heavy snow avalanche hazard that has kept the soil stripped to bedrock. Roads or other construction have a stable base, but the skeletal soils have a strong creep.

This subsection offers as wide a variety of challenges to management as there is anywhere south of the Salmon River: Its closeness to the Sawtooth Recreation and Wilderness area; its high land values associated with Sun Valley (values which, in a few years, will expand up and down the Wood River valley); its critical big game winter range situation; its need to continue rehabilitation livestock grazing areas; its need to utilize timber resources in a way that will not permanently detract from watershed and esthetic values; and the need to coordinate decisionmaking with State and local planning efforts.

Looking at ridge systems typical of Boulder-Pioneer Subsection (3).

Looking northwest from Amber Lakes into glaciated landtypes of Boulder-Pioneer Subsection (3).

Subsection 3 - Boulder-Pioneer Subsection

The Boulder-Pioneer Subsection is an area almost 3/4 million acres in extent consisting of a high relief mountain chain which separates the Wood and Big Lost Rivers. The northwest portion also separates the headlands of the East Fork of the Salmon from a portion of the headwaters of the Main Fork of the Salmon River. The maximum difference in elevation is above 5,000 feet (6,000 to 11,700 feet). Local relief of 3,000 feet is common within most of the major tributaries on the south and west portions of the area and above 2,000 feet on the north and east portions of the area.

Geologically, this subsection can be divided into three areas. The Pioneer Mountains south of Summit Creek--this mountain range divides the Wood and Big Lost River drainages. It is an area where much of the geology comes together. On the western side of the Pioneers, geology consists of thrust and folded Paleozoics (primarily Wood River and Milligen formations). Hewett's section on the slopes southeast of Bellevue gives some idea of the lithology that can be found in the Wood River formation.

	Feet
Sandstone, calcareous, bluish gray	600+
Limestone, dark gray, no fossils; contains many white calcite veinlets, persistent	80
Sandstone, calcareous, gray	200
Sandstone, buff, not calcareous	150
Sandstone, coarse, calcareous, gray	240
Shale, buff	50
Sandstone, calcareous, bluish gray, with beds of buff sandy shale	300
Sandstone, calcareous, bluish gray; veins of black calcite	50
Shale, sandy buff	20
Limestone, siliceous, bluish gray, fossiliferous	35
Limestone, white	12
Conglomerate, containing many lenses in which the pebbles range from 1-4 inches in diameter; fossils locally abundant in sandy layers	300
	2,037

The Milligen formation is dominantly thin to thick bedded argillite with minor amounts of imbedded quartzite and fine conglomerates.

The eastern portion of the Pioneers contains metasedimentary rocks which have been tentatively identified as counterparts of the Precambrian Belt super group.

Umpleby, et al., (1930) described two units of metasedimentary rocks which were named the Hyndman Peak Formation (mpCsHy) and the East Fork Formation (mpCsE). These units are found at the head of Hyndman Creek and the East Fork of the Wood River which are located east of Ketchum on the Hailey AMS map. Dover (1969) updated the original work and the following rock descriptions are his.

> The Hyndman Peak Formation (about 5,200 feet thick) is divided into four members which are labeled A (base) to D (top). Member A is a pelitic schist (200 feet thick), Member B is a gneissic quartzite (1,200 feet thick), Member C, a green banded calc-silicate rock is 600 feet thick, and Member D is another gneissic quartzite (1,400 feet thick).
>
> The East Fork Formation (about 4,000 feet thick) is also divided into four members. Member E is a 700-foot thick dolomitic marble, Member F is a 300-foot thick vitreous quartzite, Member G is an 800-foot thick marble and Member H is 2,000 feet of what may be Kinnikinnick quartzite.
>
> Beneath the two Precambrian formations is a sheet-like intrusion of Idaho Batholith, and this sheet is underlain by a migmatite complex which is exposed in the central part of the Pioneers at the heads of Kane Creek and upper Wildhorse Creek.

It should be noted that the sequence, thrusted metasediments overlying batholith with batholith overlying migmatites, is essentially the model proposed by Hamilton (1973) for the Boulder Batholith in Montana.

The Glaciated Fault Scarp headlands of the Boulder and Pioneer Mountains dominate the appearance of this subsection looking east from Wood River Valley. At least 20 percent of the area above 9,000 feet is comprised of strongly glaciated lands. These lands are generally scoured and sparsely vegetated. About another 20 percent of the area occupies glacial trough lands. These lands have thicker soils and are more heavily vegetated than the strongly glaciated areas. Both landtype associations occur in all major rock types. Most of the rest of the area is in the Wood River and Challis Mountain lands. These are mostly steep, moderately to strongly dissected slopes reflecting mainly fluvial erosional processes.

Soils in the Challis Mountain Land Group have medium textured surface horizons and medium or moderately fine textured subsurface horizons. Angular coarse fragments are common throughout the profile. These soils have the strongest horizon development of any of the soils in the study area. Soil depths on the rock structured units range from 12 to 30 inches. Soil depths on the other landtypes range from 24 to 50 inches. Soil fertility ranges from moderate to high for most of these soils. Infiltration rates are mostly moderate, and permeability is slow to moderate.

Uniform texture and depth, high percentages of coarse fragments, and dark colored surface horizons characterize the soils in this land group. Except for the soils on the Rock Structured Canyon Lands, soil depth is usually greater than 30 inches. Surface textures are loam or sandy loam. Subsoil textures are commonly sandy loam. Small chert-sized rock fragments are present throughout the profile, generally in excess of 50 percent by volume. Because of good soil structure in the surface horizon, the inherent erosion hazard of these soils is moderate or lower. The soils in this land group have excellent water-handling properties. Water-holding capacity is moderate or higher because of the great soil depths. Infiltration rates are high and soil permeability is good. Although soil fertility is only moderate for these soils, they are among the most productive soils in the study area, mainly because of their excellent water-handling properties.

Most of the landtypes in this land group have soils characterized by cobbly loam texture, depths of 10 to 40 inches, and slight to moderate horizon developments. The deeper soils are moderately productive. The rock structured landtypes have shallow soils with little horizon development. The infiltration and permeability rates are moderate for most of the soils in this group. The shallow soils show lack of horizon development, sandy texture, high erosion hazard, and low fertility.

Soils on most of the landtypes in this land group are characterized by shallow depth (usually less than 10 inches), lack of horizon development, sandy texture, high erosion hazard, and low fertility. The soils on the Cirque Basin Landtype, however, are much deeper (usually 30 inches or more to bedrock) with a sandy loam texture, well-developed horizons, and high fertility.

On the Salmon River and Big Lost River drainages, Douglas fir/mountain snowberry and Douglas fir/arnica are the predominant types associated with Challis volcanic geology. Mountain big sagebrush/Idaho fescue is interspersed and interfingered with these two types. At higher elevations subalpine fir/arnica predominates. There are some atypical pockets of Douglas fir/arnica and subalpine fir/elksedge at higher elevations on the volcanic soils. Small amounts of lodgepole pine/Idaho fescue occur on glacial outwash terraces in the river bottoms. At higher elevations along the east and northeast divide between the Wood River and both the Salmon and Big Lost River, subalpine fir/elksedge is the predominant type with isolated pockets of subalpine fir/mountain maple.

On the Wood River side of the divide, Douglas fir/pinegrass is the predominant timber type with subalpine fir/elksedge predominant at higher elevations. Aspen/mountain snowberry occurs in pockets throughout. Mountain big sagebrush/mountain brush is the predominant sagebrush there with some mountain big sagebrush/mountain snowberry.

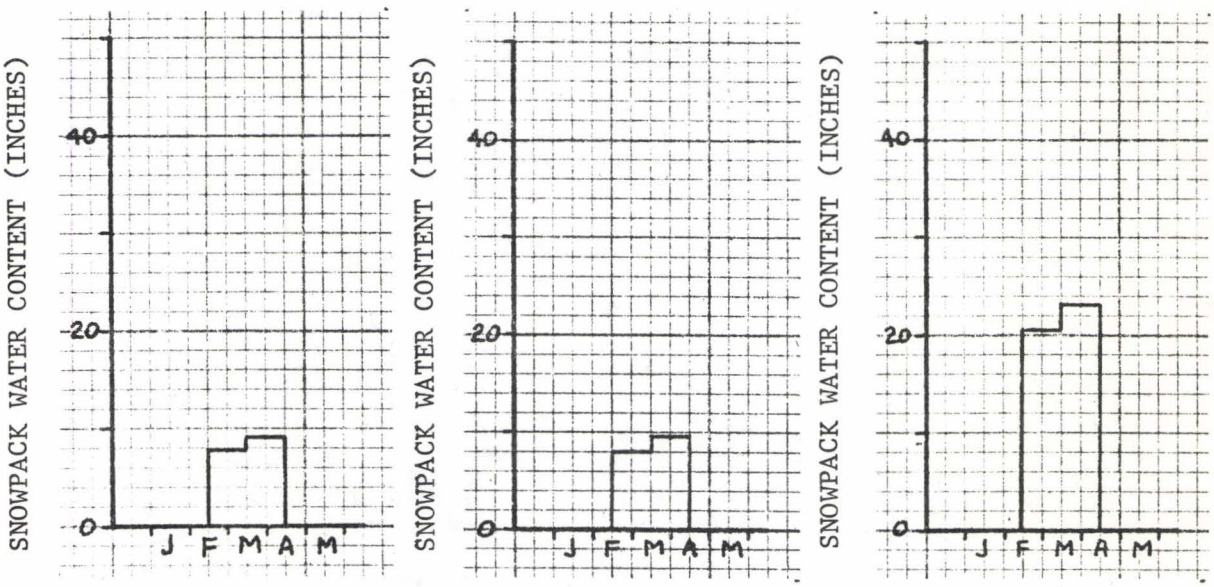
Select stands of old limber pine occur at high elevations on Wood River sediments.

Arnearia cushion plant, alpine fescue and Ivesia gordonii cushion plant communities are found at the highest elevations at and above timberline.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.8-2.6	
10	24	2.6-3.4	
25	24	2.8-3.8	2.6 & 4.2
10	6	1.5-2.0	
25	6	1.6-2.2	1.5 & 2.4

Figure 2 shows the effect of elevation and reduction of precipitation eastward for three snow courses.

Figure 2


SNOWPACK WATER CONTENT (INCHES)
40
20
0
J F M A M
MONTHS
STICKNEY MILL
ELEV. = 7500
SNOWPACK WATER CONTENT (INCHES)
40
20
0
J F M A M
MONTHS
COPPER BASIN
ELEV. = 7650
SNOWPACK WATER CONTENT (INCHES)
40
20
0
J F M A M
MONTHS
LOST WOOD DIVIDE
ELEV. = 7900

The White Clouds Subsection looking west above Boulder Lakes (4).

Subsection 4 - White Clouds Subsection

The White Clouds Subsection is an area of about 70,000 acres lying mainly between 7,000 and almost 12,000 feet, and is comprised mainly of the Strongly Glaciated and Glaciated Landtype associations (as identified by the special White Cloud, Boulder, Pioneer study for the Sawtooth National Recreation Area study). The major geologic feature is the White Cloud stock surrounded by the Milligen and Wood River formations. The stock is mostly quartz monzonite. Bennett (1973) theorized that they represented a late phase of the Idaho Batholith and were forcibly emplaced. Much of the Wood River and Milligen rocks in the area have been metamorphosed (recrystallized) by the emplacement of the stock into whitish calcic silitcates. Soils in the area are typically shallow, deep sandy to coarse loamy, and skeletal.

On the west side of this subsection subalpine fir/grouse whortleberry predominates on north slopes with subalpine fir/elksedge dominant on south slopes. Much of the area occupied by both these types is now in seral lodgepole pine. On the east side of this subsection, subalpine fir/arnica is the dominant timber type on north slopes with some potential subalpine fir/elksedge occurring on south slopes. Some small areas of Douglas fir/elksedge occur on lower elevation south slopes. Subalpine big sagebrush/elksedge and mountain big sagebrush/mountain snowberry are the dominant sagebrush types occuring on some south slopes.

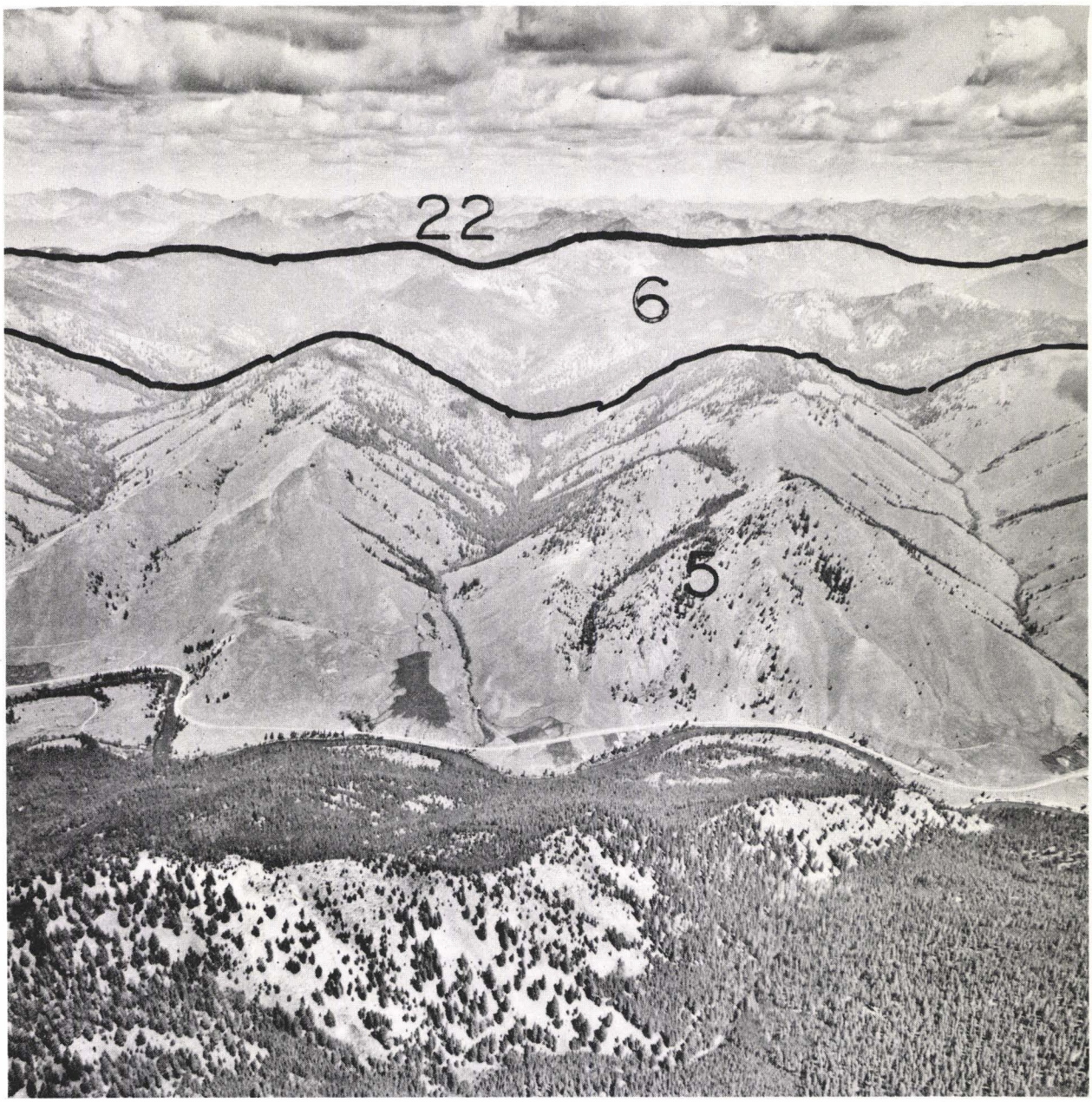
Small areas of cushion plant communities occur on ridgetops at and above timberline. Whitebark pine occurs scattered throughout and forms the timberline savannah. Cirque basins have a wide diversity of high elevation willow and meadow types.

Average annual precipitation ranges from 25-30 inches and runoff from 15-20 inches. The following shows the ranges in precipitation that can be expected from 6- and 24-hour duration storms from several selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.8-2.2	
10	24	2.6-3.0	
25	24	3.0-3.4	
10	6	1.5-1.7	
25	6	1.8-2.0	

The challenge to management of this area has been well publicized recently in the White Cloud mining controversy. The sensitive nature of the alpine ecosystem is the key to its management.

Looking west up Railroad Ridge in East Fork of Salmon River Subsection (5). The northern edge of the White Clouds Subsection (4) and the southern end of the Challis Subsection are also visible (6).



Looking across Salmon River in East Fork Salmon Subsection (5) into Challis Subsection (6), and into Upper Middle Fork Salmon Subsection (22) of the Southern Batholith Section (I).

A typical view of the East Fork Salmon River Subsection (II-5) with the White Clouds Subsection (II-4) in the background.

Subsection 5 - East Fork Salmon River Subsection

The East Fork Salmon River Subsection is about 1/4 million acres, largely in the Bayhorse area mapped by Ross (1937). Major drainages in the subsection include the Salmon River and the East Fork of the Salmon River. Elevations range from 5,300 to 9,700 feet. An inclusion of 3,000 feet is in the main Salmon Canyon. Relief of 1,000 feet occurs east of the East Fork of the Salmon, and about 2,000 feet elsewhere in the subsection. The area is covered with Challis volcanics with exposures of Kinnikinnick quartzite and Laketown dolomite common.

The major structure in the region is an anticline near Bayhorse and Clayton (figure 16). This is one of the major structures in this part of Idaho. Ross believed that much of the deformation in this region was associated with the intrusives of the Idaho Batholith. Later, milder deformation occurred in Tertiary times when the Challis volcanics were slightly deformed. Ross suggested that the northeast trending fault system (see Challis linear map) is Teritary in age whereas the northwest system is probably Mesozoic (batholith associated).

Ross's discussion of the Challis volcanics explains much about the present topography. The volcanics were extruded into an area of considerable relief (probably similar to the present topography). This topography resulted in much slumping and internal deformation by gravity sliding of flows and ash falls. Ross said that the entire Bayhorse area was covered by volcanics except for the very highest peaks. Grand View Canyon is covered by Yankee Fork rhyolite which rests directly on Jefferson dolomite without any latite-andesite or Germer tuffaceous members. The Post Challis surface was mature and is reflected in many sections of the Bayhorse Region by flat ridge crests which are near or above 9,000 feet. Railroad Ridge, just north of the White Cloud stock is a remnant of this surface.

Ross noted that two stages of glaciation had affected the region. The Nebraskan glacial period is evidenced by glacial material which itself has been glaciated during the latter Wisconsin glacial period. Some of this material covers the top of Railroad Ridge. Nebraskan glacial deposits are found only above 9,000 feet. Complex erosion followed the Nebraskan period as is evidenced by several sets of terrace gravels at different elevations. This dissected surface was glaciated in Wisconsin times and evidence of this glaciation is found at elevations ranging from 6,500 to 8,000 feet. The higher ranges like the White Clouds were intensely eroded by these glaciers. The present topography is similar to that of Wisconsin time with only slight, subsequent fluvial erosion.

Soils in the Challis Mountain Land Group have medium textured surface horizons and medium or moderately fine textured subsurface horizons. Angular coarse fragments are common throughout the profile. These soils

have the strongest horizon development of any of the soils in the study area. Soil depths on the rock structured units range from 12 to 30 inches. Soil depths on the other landtypes range from 24 to 50 inches. Soil fertility ranges from moderate to high for most of these soils. Infiltration rates are mostly moderate, and permeability is slow to moderate.

Because of steep slopes, the inherent erosion hazard for most landtypes in this group is moderate or high. However, because of the relatively good soil productivity, disturbed areas regenerate fairly easily. The nonrock structured landtypes have the highest mass failure hazard in the study area. This hazard is localized on these types and ranges from moderate to high. Except for the localized mass failure hazards, this land group is one of the more stable land groups.

This subsection contains a wide elevational range and as a result the plant communities are diverse as well. However, because of the Sawtooth-White Cloud rain shadow, they are drier types.

The uppermost part of Railroad Ridge is dominated by a unique cushion plant complex containing typical alpine species as well as some common to the foothills. The Whitebark pine barren zone occurs as a fringe around the ridge and grades into subalpine big sagebrush/elksedge and mountain big sagebrush/mountain snowberry, particularly on south slopes. Some subalpine fir/arnica occurs at higher elevation north slopes, but this type quickly grades into Douglas fir/arnica and some Douglas fir/mountain snowberry. Some pockets of Douglas fir/Idaho fescue and Douglas fir/ground juniper occur at the drier portion of the Douglas fir zone. Some limber pine occurs on south aspects along the Salmon River. At lower elevations mountain big sagebrush/Idaho fescue and mountain big sagebrush/bluebunch wheatgrass are dominant. At the lowest elevation Wyoming big sagebrush/bluebunch wheatgrass is dominant. At the lowest elevation Wyoming big sagebrush/bluebunch wheatgrass and scattered islands of salt desert shrub types occur.

Average annual precipitation is only 15-25 inches showing the "rain shadow effect." Runoff ranges from 1 to 10 inches. The following shows the range in precipitation for 6- and 24-hour duration storms that can be expected from selected frequencies.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.6-1.8	2.0
10	24	1.8-2.4	2.6-2.8
25	24	2.2-3.0	
10	6	1.3-1.4	1.5
25	6	1.4-1.6	1.8

The challenges to management in this area are generally associated with managing vegetation in a xeric-cold climate and with reducing mining and road building impacts.

Subsection 6 - Challis Subsection

The Challis Subsection occupies over 300,000 acres of that country draining east into the Salmon River from around Clayton to about Williams Creek with elevations ranging from 5,000 to 10,00 feet. Dominant local relief, however, ranges from about 2,000 to 2,500 feet. The major geologic unit is Challis volcanics with minor amounts of Kinnikinnick quartzite. Just to the northwest of Rattlesnake Creek on a line to Iron Lake is the contact between the Challis volcanics and Precambrian metasediments (Swauger and Lemhi quartzites). The lineation of the unit appears parallel to the general structural features associated with the Morgan Creek lineation.

The headlands above 8,000 feet show moderate to weak expression of alpine glaciation. Some of the broad ridge lands may still have remnants of Pre-Wisconsin glaciation.

Using Salmon National Forest nomenclature, this subsection can be grouped into the following landtype associations:

Landtype Association	Approx. Proportion (Percent)
Volcanic Strongly Glaciated Lands	5%
Volcanic Glacial Trough Lands	10%
Volcanic Cryoplanated Lands	20%
Volcanic Steep Canyonlands	5%
Volcanic Fluvial Lands	35%
Quartzite Glacial Trough Lands	65%
Quartzite Cryoplanated Lands	5%
Quartzite Fluvial Lands	15%

Volcanic Strongly Glaciated Lands are typically alpine glaciated areas. They are comprised of cirques, cirque lakes, steep rocky ridges and the upper portion of the glacial troughs. Elevations range from 7,000 to 10,000 feet. Slopes are long and very steep. Timber productivity is very low. Soil mantles are thin or nonexistent. Snowslides are common.

Volcanic Glacial Trough Lands are formed by glaciers which carved out "U" shaped valleys. The valley bottoms are concave with glacial till forming the soils of the valley floor. The side slopes are steep with shallow to moderately shallow soil mantle. The glacial trough lands may be some of the better Douglas fir sites in the volcanic soils because the soil has boulders and cobble mixed in the soil allowing water to percolate through the soil. Piping of water through the soil makes for trouble in road building. Live water may be intercepted at shallow depths. The clay soils will make roads usable only during the dry seasons. Land slump will occur on the steep side slopes where wet areas are disturbed.

Volcanic Cryoplanated Uplands generally occur at elevations greater than 7,000 feet. The dominant slope forming process has been frost churning. These lands occur along ridgetops. The ridges are rounded and the slopes are convex. Slopes are less than 50 percent. Soils are clay loams to clays. Soil temperatures are cold. Much of the water is handled by overland flow. Roads built on these soils will be slick and use will be limited to dry seasons. Erosion hazards are moderate to high. The land slump hazard is high, especially where road cuts intercept springs.

Volcanic Steep Canyonlands occupy the extremely steep slopes adjacent to some of the tributaries of the Salmon. Rock outcrops form a major portion of these lands. Soils that form on these slopes are very thin. Removal of vegetation from these slopes will create landslide potential areas due to the amount of clay in the soil. Roads built in these canyons will be very slick and will require much rock blasting. These canyons should be avoided as a means of gaining access to the Forest.

Volcanic Fluvial Lands occur primarily on the foothills in the lower portions of the mountain slopes. The slope forming process has been the movement of water downslope. Ridges are rounded and the valleys tend to have bigger flood plains than the valleys in the quartzite and granitics. The soils are loams to sandy clay loams.

Quartzite Glacial Trough Lands often lie immediately adjacent to Strongly Glaciated Quartzite Lands and are dominated by the long, U-shaped valleys carved by the glacial "tongues" which crept down out of the high country. These troughs have steep (45 to 70 percent) sideslopes and broad, gently sloping valley bottoms. On the sideslopes soils are shallow to moderately deep, medium to coarse textured and cobbly. Erosion hazards are moderate. Snowslide hazards are high. The valley bottoms are generally stable and well drained but the high runoff from the adjacent glaciated lands and heavy subsurface flow could lead to road washouts and other related problems due to interception of flow. These lands often support commercial stands of timber but the cold climate limits revegetation success. Care must be taken not to disturb large amounts of vegetation in these troughs. This association often contains Cryoplanated Upland Landtypes.

Quartzites Cryoplanated Basin Lands occur in the northwestern part of the subsection. Frost churning and fluvial action have been the slope forming processes. The ridge tops are less rounded and drainages more V-shaped than the Granitic Cryoplanated Basin Lands. Slope gradients range from 20 to 60 percent. Soils are gravelly fine sands to gravelly sandy loams. The erosion hazard of these soils is low. Roads built on these lands should be stable and require a minimum of maintenance. The regeneration potential of lodgepole seems to be very high on these lands in comparison to the Granitic Cryoplanated Basin Lands. The major tree species is lodgepole pine with some Douglas fir.

Quartzite Fluvial Lands occur at elevations between 4,000 and 7,000 feet. The primary slope forming process has been the movement of water downslope. The ridges are sharp and the valleys are V-shaped. Slopes are generally from 45 percent to 70 percent. The soils are medium to coarse textured, gravelly sandy loams and gravelly loams. The erosion hazards are low to moderate. Roads built on these soils are stable, require low maintenance, and can be used year around. Water generally moves downslope via subsurface flow but overland flow can occur on steep slopes during peak periods.

At the lowermost elevations, Wyoming big sagebrush/bluebunch wheatgrass is dominant with some pockets of low sagebrush. At intermediate elevations and higher elevations on south slopes, mountain big sagebrush/bluebunch wheatgrass and mountain big sagebrush/Idaho fescue become dominant.

Douglas fir/Idaho fescue dominates at the lowermost and driest part of the Douglas fir zone on north slopes particularly on dacite parent material. This type quickly grades into subalpine fir/arnica on higher elevation quartzite on north slopes, with pockets of Douglas fir/bluebunch wheatgrass on quartzite on south slopes.

In the northern part of the subsection, the pinegrass phase of the Douglas fir/spiraea becomes dominant, particularly on quartzite parent materials, with small pockets of Douglas fir/mountain mahogany on quartz monzonite. Some subalpine fir/elksedge occurs on dacite material.

The whitebark pine barren zone is prominant along the western border of this subsection on trachyte parent material.

Some of the following are tentative observations of parent material/habitat type relationships. Such relationships are probably moisture-temperature oriented:

Some mountain big sagebrush/Idaho fescue, then Douglas fir/Idaho fescue on dacite.

Much subalpine fir/Arco on quartzite with pockets of Douglas fir/bluebunch wheatgrass on south slopes on quartzite.

Both Douglas fir/Juco plots here and Juco/Spbc hybrid stands
1 on diorite
1 on dacite

Most Douglas fir/white spiraea here is caru phase on quartzite.

Small pockets of Douglas fir/Cele on quartz monzonite.

Some subalpine fir/elksedge on dacite.

Subalpine fir/whitebark pine along W. border on trachyte.

Average annual precipitation is about 15-30 inches with runoff ranging from about 1-10 inches indicating a strong "rain shadow" effect. The following shows the range in precipitation for 6- and 24-hour duration storms at various selected return intervals (frequency events).

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.0-1.6	1.8
10	24	1.6-2.4	2.6
25	24	1.8-2.6	3.0
10	6	1.1-1.3	
25	6	1.3-1.6	1.8

Land management problems associated with this subsection are associated with minimizing impacts from mining and road building activities and in the scientific management of plant communities under relatively high stress moisture and temperature regimes.

Subsection 7 - Salmon Mountains Subsection

The Salmon Mountains Subsection is an area of about 60,000 acres consisting of the Salmon River Mountains which form the east facing "Front" from Williams Creek to North Fork. Elevations range from about 4,000 feet near Salmon to about 9,200 feet at Lake Mountain. Dominant relief of the drainages within the subsection, however, is about 2,000 to 3,000 feet.

The three major rock types in the area are quartzites, granitics, and Challis volcanics.

The highest elevations contain weakly developed cirques and one or two of the main drainages have well developed Glacial Trough Landtypes in their upper reaches. Other upper ridges and slopes are in the Cryoplanated Landtype associations and the rest of the slopes are in the Fluvial Landtype associations. The approximate distribution of land associations is as follows:

Landtype Association	Approx. Proportion (Percent)
Quartzite Steep Canyonlands	10%
Quartzite Fluvial Lands	40%
Volcanic Fluvial Lands	15
Quartzite Cryoplanated Uplands	15
Volcanic Cryoplanated Uplands	5
Quartzite Glacial Trough Lands	15 (includes some weak cirques)
Quartzite Strongly Glaciated Lands	T

Quartzite Steep Canyonlands are the very steep slopes immediately adjacent to the Salmon River and its tributaries in quartzite geology. Slopes range from 50 to 90 percent and are generally 70 percent or more. Soils are often shallow and medium to coarse textured. South aspects are generally dry and sparsely vegetated with wheatgrass and a minor amount of ponderosa pine/wheatgrass habitat types. North aspects are cooler and often contain commercial stands of timber. Douglas fir habitat types are most common. Mass failure hazards are medium and erosion hazards are generally medium. These lands are more stable than their granitic counterparts but soil disturbing activities are still potentially hazardous because of the streams immediately below. These lands are important big game winter range in many cases.

Quartzite Fluvial Lands occur at elevations between 4,000 and 7,000 feet. The primary slope forming process has been the movement of water downslope. The ridges are sharp and the valleys are V-shaped. Slopes are generally from 45 to 70 percent. The soils are medium to coarse textured, gravelly sandy loams and gravelly loams. The erosion hazards are low to moderate. Roads built on these soils are stable, require low

maintenance, and can be used year around. Water generally moves downslope via subsurface flow but overland flow can occur on steep slopes during peak periods.

Volcanic Fluvial Lands occur primarily on the foothills in the lower portions of the mountain slopes. The slope forming process has been the movement of water downslope. Ridges are rounded and the valleys tend to have bigger flood plains than the valleys in the quartzite and granitics. The soils are loams to sandy clay loams.

Quartzite Cryoplanated Uplands occur along ridgetops and high divides. They are generally at elevations greater than 7,000 feet. They are characterized by cold climate, short growing season, rounded ridges and gentle slopes (less than 50 percent). The dominant slope forming process has been frost action. Soils are moderately coarse textured, gravelly and cobbly. They are generally well drained. Overland flow is rare. Soil temperatures are cold and productivity levels and revegetation potentials are lower than in the Quartzite Fluvial Lands. Most common habitat types are subalpine fir/grouse whortleberry and Douglas fir/pinegrass. Erosion hazards are very low to low with springs and seeps causing local problems. These lands are usually very stable road locations.

Volcanic Cryoplanated Uplands generally occur at elevations greater than 7,000 feet. The dominant slope forming process has been frost churning. These lands occur along ridgetops. The ridges are rounded and the slopes are convex. Slopes are less than 50 percent. Soils are clay loams to loamy clays. Soil temperatures are cold. Much of the water is handled by overland flow. Roads built on these soils will be slick and use will be limited to dry seasons. Erosion hazards are moderate to high. The land slump hazard is high especially where road cuts intercept springs. In the Silver Creek and Porphyry Creek areas, the volcanic rocks are rhyolite which is similar to granite in mineral composition. The hazards and potentials of these areas are similar to the Granitic Cryoplanated Uplands. The tree species are Douglas fir, subalpine fir, and lodgepole pine.

Quartzite Glacial Trough Lands often lie immediately adjacent to Strongly Glaciated Quartzite Lands and are dominated by the long, U-shaped valleys carved by the glacial "tongues" which crept down out of the high country. These troughs have steep (45 to 70 percent) sideslopes and broad, gently sloping valley bottoms. On the sideslopes, soils are shallow to moderately deep, medium to coarse textured and cobbly. Erosion hazards are medium. Snowslide hazards are high. The valley bottoms are generally more stable and well drained but the high runoff from the adjacent glaciated lands and heavy subsurface flow could lead to road washouts and other related problems due to interception of flow. These lands often support commercial stands of timber but the cold climate limits revegetation success. Care must be taken not to disturb large amounts of vegetation in these troughs. The association often contains Cryoplanated Uplands Landtypes.

Quartzite Strongly Glaciated Lands are typically alpine glaciated lands and occur in the Lemhi Range and the Beaverhead Range. Scattered patches occur in the Allan Mountain area. They are comprised of cirques, cirque lakes, steep rocky ridges and the upper portion of the glacial trough. Elevations range from 7,000 to 10,000 feet and more. Slopes are long and steep. Soil mantles are thin or nonexistent. Timber productivity is low.

At the lowermost elevations, Wyoming big sagebrush/bluebunch wheatgrass is dominant. At intermediate elevations and higher elevations on south slopes, mountain big sagebrush/bluebunch wheatgrass and mountain big sagebrush/Idaho fescue become dominant.

Douglas fir/pinegrass and the pinegrass phase of the Douglas fir/spiraea are the dominant lower elevation timber types particularly on quartzite parent material. Mid-to-upper elevations are dominated by subalpine fir/pinegrass and the pinegrass phase of the subalpine fir/grouse whortleberry. Subalpine fir/grouse whortleberry is the dominant type with some inclusions of subalpine fir/arnica. The whitebark pine barren zone occurs at the highest elevations in this subsection.

Average annual precipitation ranges from about 10-25 inches and runoff from about 1 to 5 inches. The following shows the range in precipitation for 6- and 24-hour duration storms for selected expected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.0-1.4	
10	24	1.6-2.0	
25	24	1.8-2.4	
10	6	1.1-1.3	
25	6	1.3-1.4	

The main challenge to land management in the area is in coordinating livestock use with big game winter range, with timber regeneration on certain habitat types, and with coordinating timber resource use with watershed and esthetic values.

Granite Mountains Uplands Subsection (1).

Section III - Salmon Uplands Section

The Salmon Uplands Section is a large area, approximately 7,000 square miles, bisected by the Salmon River Canyon. About 75 percent of it drains into the Salmon River. Only a small portion (<5%) drains into the Bitterroot River. About 20 percent drains into the Selway River. The central two-thirds of the area appears to be remnant of a former land surface which generally had a common structural base level that was uplifted to much higher elevations. Subsequent structural changes have differentiated the areas to one degree or another but the former relationships are apparent. Reid postulated the geomorphic sequence for several of these areas (see Section III in Geology Report). The structural relationships to an "old land surface" are more complex and less well expressed on the eastern one-third of the section.

Twenty-two subsections have been identified in Table 13.

Although elevations in the area range from 7,000 to over 10,000 feet, the dominant relief of some subsections ranges from 800 to 1,500 feet, in others from 1,500 to 2,500 feet. The Canyonland Subsection has relief in excess of 5,000 feet.

Table 13

Map Symbol	Subsection Name	Range in Elevation	Dominant Local Relief	Median Elevation
1.	Granite Mountains Uplands Subsection	4000-8600	1500/2500	6400
2.	Burgdorf Basin Subsection	5100-8600	1500-2000	6800
3.	Chamberlain Basin Subsection	5500-7500	1000	6500
4.	Salmon River Canyonlands Subsection	1700-9000	3000-5000	Range Far east 5500 Far west 4000
5.	Big Horn Crags Subsection	5000-10050	1500-2500	7500
6.	Panther Creek Canyon Lands Subsection	3600-8450	2500	6000
7.	Panther Creek Basin and Uplands Subsection	4800-9550	800-1500	7200
8.	North Fork Salmon Breaks Subsection	4500-8400	1500-2500	6500

Map Symbol	Subsection Name	Range in Elevation	Dominant Local Relief	Median Elevation
9.	West Fork Bitterroot Streamcut Subsection	5000-8800	1500-3000	6200
10.	State Divide Uplands Subsection	5500-8700	1000/1500-2000	7000
11.	Devils Point Weakly Glaciated Lands Subsection	3800-8400	1500-2000	6200
12.	Sabe-Magruder Mountain Moderately Glaciated Uplands Subsection	3100-8850	2000/3000	7000
13.	Red River Basin Uplands Subsection	3800-8200	1000-1500	6400
14.	Buffalo Hump Glaciated Lands Subsection	5600-8900	1000/2000	7000
15.	Florence Basin Subsection	3700-7600	500-1000/2000	6000
16.	John Day Subsection	3000-7600	3000	5800
17.	Dairy Mountain Dissected Plateau Lands Subsection	2000-6200	1000/1500-2000	4500
18.	Lower South Fork Clearwater Strongly Dissected Lands Subsection	2600-6800	1500-2000	4500-5000
19.	Elk City Basin and Uplands Subsection	3500-7000	1000-1500	4800
20.	Selway Moderately Dissected Lands Subsection	1800-6800	2000-2500/1000	4600
21.	Copper Butte Dissected Glaciated Land Subsection	3000-7600	1000-1500/ 2000-3000	6000
22.	Running Creek Streamcut Land Subsection	3000-6000	2500-3000	4500

The geology of the central portion of this area is dominantly granitic. Much of the area on the west and north is bounded by "border zone" rocks. "Border zone" rocks are chiefly Precambrian metasediments which have been strongly affected by the Batholith intrusions. Much of the area in the north-central and east-central portion contains Precambrian metasediments of the Belt Super Group Rocks. Some contacts also occur with the Challis volcanics on the south-central and southeastern boundaries and contacts with the Columbia River basalts near the northwestern boundaries.

Excluding the Salmon River Canyonlands Subsection, the median elevation of this section is about 7,000 feet. It is about at these elevations in these latitudes that evidence of frost churning begins to appear. In places, these processes have had a tendency to mask the location of remnant depositions from Pre-Wisconsin glacial activities which have been reported in the literature.

At lower elevations (below the zone of strong pereglacial processes) in the Elk City Subsection, large areas of Eocene gravel deposits have been mapped. Another important characteristic of the section is the thick to thin Aeolian deposits which cover much of the central portion. The thickness of these deposits decreases rapidly south of the Salmon River, although they have been identified in the Warm Lake Basin also in Burgdorf Basin and Bear Valley-Landmark area to the south. Aeolian materials have been mixed to considerable depths by frost churning processes in some areas.

Soils on these uplands are commonly deep and overly relatively highly weathered bedrock materials. Thick soils overlying highly weathered border zone rocks high in mica are some of the most massively unstable lands in the area. Thin soils overlying highly weathered granitics are among the highest sediment producers in the area.

This section may be subdivided into five subunits. They are: (1) The northeastern subunit, encompassing Subsections 8, 9, 10 and 11; (2) the southeastern subunit encompassing Subsections 5, 6, and 7; (3) the Salmon River Canyon subunit containing Subsection 4; (4) the western subunit encompassing Subsections 16, 17, and 23; (5) the central subunit containing the remaining Subsections 1, 2, 3, 12, 13, 14, 15, 18, 19, 20, 21, and 22.

The northeastern subunit (1) is dominated by the Douglas fir/pinegrass and the subalpine fir/beargrass types. The southeastern subunit (2) is dominated by the Douglas fir/pinegrass and subalpine fir/grouse whortleberry types.

The Salmon River Canyon subunit (3) contains a wide diversity of habitat types. The western subunit (4) is characterized by Pacific bunchgrasses. The central subunit (5) is characterized by subalpine fir, Douglas

fir/Idaho fescue, Douglas fir/pinegrass, ponderosa pine/Idaho fescue, with open slopes of bluebunch wheatgrass/Idaho fescue and bluebunch wheatgrass/sandberg bluegrass. The eastern part is characterized by mountain big sagebrush/bluebunch wheatgrass.

The western subunit (4) is primarily under the direct influence of the Pacific maritime climate and contains a predominance of timber habitat types characteristic of northern Idaho. The dominant types include Douglas fir/ninebark, Douglas fir/common snowberry, subalpine fir/beargrass, and grand fir/queencup. The western red cedar is also an important series in this area.

The average annual precipitation for the section is 31.22 area-inches. This includes an average range of less than 10 inches in the lowest elevations to over 50 inches in high mountainous areas. The main reason for the signficantly less precipitation at lower elevations is mountain barriers to the normal flow of storms. These barriers intercept a considerable portion of precipitation. The less frequent cyclonic storm activity within this section as compared to the northern portion of the State is of secondary significance.

Two wet seasons occur within the section. Cyclonic storms from the Pacific Ocean account for the typical wet winter months of November through January. High altitude storms from the Gulf of Mexico bring in precipitation during May and June. The latter wet season is often of greater magnitude in terms of average total monthly precipitation than the former. High elevation areas within the section should, however, show monthly winter precipitation totals slightly greater than the spring-early summer (May and June) monthly values.

April 1 snow surveys, record highest winter water content. Snow packs contain approximately 50 to 55 percent of the total annual precipitation. Slopes are typically bare at an elevation of 3,500 feet or less during the winter.

The average annual maximum, mean, and minimum air temperatures for this section at median elevation are 50.7°F., 37.0°F., and 22.4°F., respectively. The maximum-minimum variation is 28.3°F.

The elevational relief within the section is about 8,000 feet. This range in elevation, which is one of the highest for the Batholith sections, can account for a 28°F. temperature difference from the highest and lowest areas of the section at any one time.

Growing seasons within valleys drained by the Clearwater River vary from about 160 days in the low elevation areas to less than 30 days within the highest terrain. Salmon River valleys have growing seasons of less than 190 days around Riggins to about 100 days near Salmon. The growing season within the headwaters of the Little Salmon River is generally less than 40 days.

The Salmon Uplands Section produces 5,303,000 acre-feet of water annually. This is equal to 13.62 inches of water yielded from the entire section. An average annual range of 1 to 44 inches of runoff occurs from within the section.

Annual runoff accounts for 43.6 percent of annual precipitation. This leaves 56.4 percent for evapotranspiration and other minor, unmeasurable water losses. These losses amount to 6,852,000 acre-feet (17.60 area-inches) annually.

Subsection 1 - Granite Mountain Uplands Subsection

This subsection is slightly less than 1/4 million acres of glaciated uplands lying south of the Salmon River Canyon, east of the Little Salmon River Canyon and north of Payette Lakes. The dominant relief in the area is less than 1,500 feet. Relief up to 2,500 feet is common in the entrenched main tributaries. These tributaries follow the extremely strong fault zones associated with the north-south structural orientation of the area.

Almost the entire area appears to have been heavily glaciated by essentially the same thick ice sheet. The effect of these kinds of activities (Ross has identified two periods of glaciation) was to give a generally "stripped" or scoured appearance.

Glacial movement, however, generally followed the antecedent fault-directed drainage patterns. Consequently, many of these slopes are covered with glacial till of varying thickness.

Gneissic quartz diorite and gneissic quartz monzonite are the dominant rocks in the area. Foliation weakens in these rocks from west to east. Columbia River basalts are at Lava Butte and north from Hazard Creek to Rattlesnake Creek. The Lake Creek drainage is underlain by Triassic sedimentary rocks.

About 80 percent of the area is occupied by Cirque Lands and Glacial Trough Lands; about 15 percent by Depositional Lands; and about 5 percent by Steep Dissected Fluvial Lands.

Soils in the area are quite variable ranging from loams to loamy sands and shallow to extremely thick. Rock outcrops in some of the ridge lands, headlands and trough lands are commonly 50 percent; on others 20 percent of the surface may contain glacial boulders.

Douglas fir/ninebark, with lesser amounts of Douglas fir/common snowberry, occupy most of the lower elevations in this unit. Alpine fir/beargrass covers the bulk of this unit with alpine fir/queencup in the warmer protected sites. Small amounts of grand fir/queencup also occur in similar sites between the Douglas fir and subalpine fir zones. Subalpine fir/whitebark pine is common on the uppermost peaks and ridges with small inclusions of subalpine fir/smooth woodrush on northerly aspects with heavy snow accumulation.

High water tables occur throughout much of this area on gentle slopes, benches, and stream terraces. In most cases, these sites are the alpine fir/bluejoint reedgrass habitat type. In a few areas, they represent natural wet meadows.

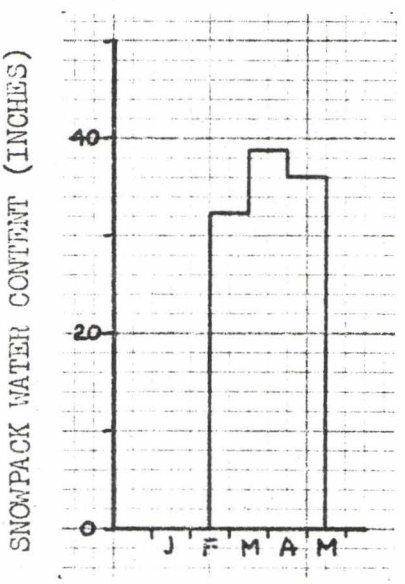
This area is one of the most efficient water producers in the state with some portions of the area producing as much as 80 percent of the precipitation as streamflow.

Average annual precipitation ranges from about 25-45 inches and runoff from 20-40 inches. Figure 1 shows the range in precipitation for 6- and 24-hour storms for selected expected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.8-2.2	
10	24	2.4-3.0	2.2 & 3.4
25	24	2.8-3.6	2.6
10	6	1.5-1.7	
25	6	1.6-2.0	

Figure 2 shows the water content of the snow pack of the snow course at Squaw Meadow; elevation 5,800 feet.

Figure 2



SQUAW MEADOW
ELEV. = 5800

This area offers a relatively broad spectrum of land management challenges from winter and summer recreation development (the area has a wide spectrum of high recreation values) to watershed, timber, forage management for livestock and big game. Fortunately, much of the area has relatively low slope stability hazards, permitting consideration of a rather wide range of choices. A key challenge in management of this subsection is the handling of very large spring runoff volumes.

Burgdorf Basin Subsection (2).

Subsection 2 - Burgdorf Basin Subsection

The Burgdorf Basin Subsection comprises about 1/4 million acres of a rolling, structurally controlled basin and upland area bounded on the north and east by the Salmon River Canyon, on the west by the Granite Mountain Uplands Subsection and on the south by the Fitsum Peak Subsection of the Southern Batholith Section. The areas strong basin characteristics are best exemplified by the meandering nature of Secesh and Warren drainages which are the main drainages in the area. These streams meander through broad alluvial deposits in the central portion of the unit.

Maximum relief in the area is about 2,500 feet; 1,500 feet is the dominant relief. More than 80 percent of the area lies between 6,000 and 7,000 feet. The adjacent Granite Mountain Uplands Subsection averages almost 1,000 feet higher in elevation. The Chamberlain Basin Subsection across the South Fork of the Salmon River and the Red River Basin Uplands Subsection across the Main Salmon River to the North, have about the same ranges in elevation as does the Burgdorf Basin Subsection and Salmon River Canyonlands Subsection. The Burgdorf area is generally more dissected with greater relief than the two latter subsections. These physiographic and structural relationships are part of the evidence used to describe the areas as an "old erosion surface" which has been subsequently uplifted to its present elevation. These areas represent the remnants of an older topography developed at a much lower altitude than it stands today. From contacts with the Challis volcanics and Columbia River basalts, it has been postulated that the surface must have developed in the latter part of the lower Miocene or very early in the lower middle Miocene.

A portion of the Warrior Mining District is in the northern part of the area. Geology in the portion of the area is mostly in the "border zone" suite of lithologies consisting mainly of gneisses, schists, and quartzites. Most of the rest of the area, however, is dominated by granitics. Larson and Schmidt noted that quartz diorite graded into the typical coarse quartz monzonite from west to east. Bedrock dominantly ranges from weathering class 4 to 5. Reed (1937) noticed two periods of the glaciation activity based on terrace gravels and valley fill materials in Warren Valley. Because its elevation is lower than the Granite Mountain Subsection, the Burgdorf Basin Subsection was not as strongly glaciated. The following table of approximate landtype association composition shows this:

Landtype Association	Approximate Proportion
Cirque Headlands and Rock Ridge Lands	15%
Glacial Trough Lands	20%
Depositional Lands	5%
Gentle Frost Churned (Cryic) Lands	15%
Steep Frost Churned (Cryic) Lands	20%
Fluvial Lands	25%

Only drainages eminating from the highest elevations show strong evidence of alpine glaciation.

Soils are dominantly coarse to moderately coarse textured, commonly stony (skeletal), and shallow to deep with deep soils on the Depositional Lands and Gentle Frost Churned Slopes, moderately deep to deep on Steep Frost Churned Slopes and some Trough Lands and commonly shallow in Cirque Headlands and Rocky Ridgelands and some Fluvial Lands. Loamy, silty, soils are common in some of the Depositional Landtypes which also contain some organic soils.

The Douglas fir zone occupies most of the lower elevations in this unit (mostly on the Fluvial Landtypes). Here Douglas fir/ninebark occurs most often with lesser amounts of Douglas fir/common snowberry and Douglas fir/pinegrass on drier aspects. In ravines and protected slopes, grand fir/tall huckleberry may also occur. Upper elevations are dominated by subalpine fir/beargrass with lesser amounts of subalpine fir/elksedge and subalpine fir/whitebark pine on the drier sites. In the same areas, subalpine fir/smooth woodrush occurs where snow accumulations persist into the growing season.

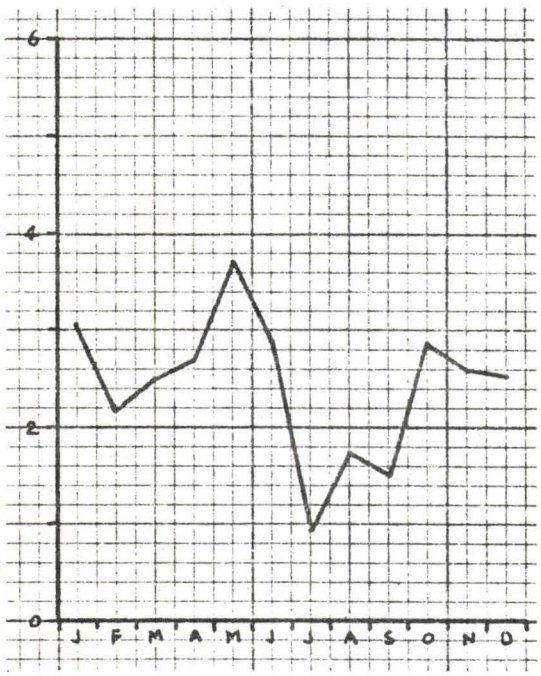
Although similar to the Granite Mountain Uplands Subsection, it has fewer areas with high water tables and contains more fluvial, lower elevation lands. Consequently, there is more Douglas fir zones and the minor amounts of subalpine fir/bluejoint reedgrass present are more restricted to stream terraces. There are also considerable stretches of glacial outwash that now support lodgepole pine on subalpine fir/dwarf huckleberry habitat type. This feature was not seen in Unit #2.

Average annual precipitation is about 25 to 40 inches and runoff about 10 to 30 inches. Figure 1 shows the range in precipitation for 6- and 24-hour storms for selected expected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.6-2.2	1.4
10	24	2.2-3.0	2.0 & 3.4
25	24	2.6-3.4	
10	6	1.4-1.7	
25	6	1.8-2.0	1.6

Figure 2 shows the average distribution of precipitation at Warren and figure 3 shows the average maximum, minimum, and mean temperatures by months.

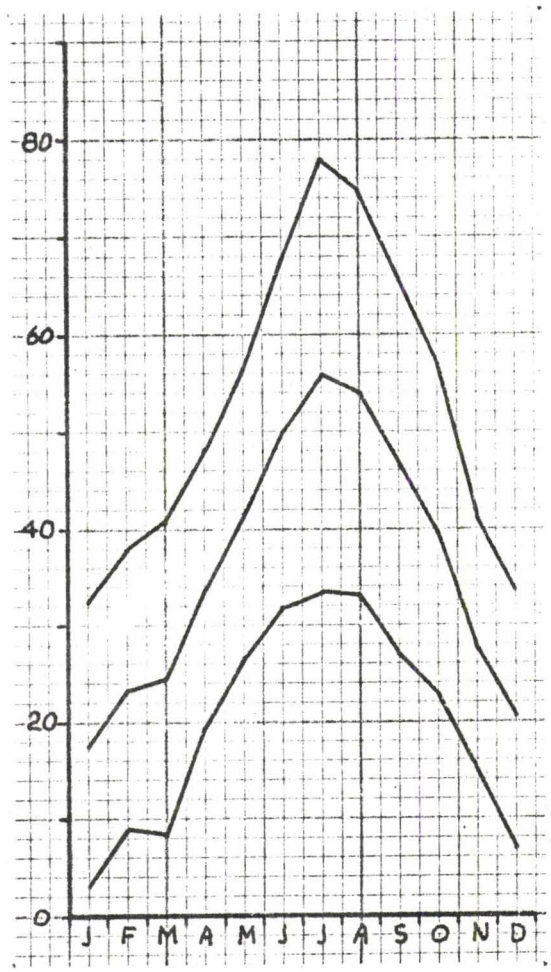
Figure 2



MONTHS

WARREN
ELEV. = 5352
YEARS = 7
A.A.P. = 29.14

Figure 3



MONTHS

WARREN
ELEV. = 5907
YEARS = 6*
52.8-36.3-19.7

Challenges to management in the area are chiefly concerned with watershed management, timber management, and with private land development in areas of high water tables (much of which has been dredge or placer mined in the past).

Chamberlain Basin Subsection (3).

Subsection 3 - Chamberlain Basin Subsection

The Chamberlain Basin Subsection is a 1/4 million acre area between the Middle and South Forks of the Salmon River. It is bounded on the north by the Salmon River Canyon Lands and on the south by the geologically complex Profile-Monumental Subsection of the Southern Batholith Section. As stated, it appears structurally related to other adjacent subsections across the major drainages and others across the main Salmon which have been identified as "old erosion surfaces."

Cater, et al. (1973) mapped most of the area as undifferentiated Idaho Batholith which includes quartz diorite, granodiorite, and quartz monzonite. A zone of grussic, (banded) quartz monzonite covers the northern and northeastern portions of the subsection. Cater describes this rock type as being older and representing greater depths than the adjoining quartz monzonite/granodiorite mass of the batholith.

Drainages in the area are dominantly in a northeasterly direction which tend to follow the same direction as the dominant lineations. These lineations are contrasting in direction to the subsections to the west (where the trend is north-south) or to the east (where the trend is north-west).

About 65 percent of the area is the Frost Churned (cryic) Rolling Basin Lands in the central portion of the subsection. Elevations range from 5,500 to 7,500 feet. The topography is rolling. Local and total relief is low. Ridge tops are broad and convex. Drainageways are broad and concave. Slope gradients are generally less than 45 percent. The soils in the area have fine sandy loam surfaces over sandy subsoils. Soils are nonstony throughout and are moderately deep over soft well weathered granitic bedrock. The climate for this large an area is probably as uniform as any region in the study area because of its general orientation and small differences in elevation. Precipitation ranges from 20 to 40 inches annually. Summers are cool and winters are cold. Morning fog is quite common in the low meadows during the summer. The abundant moisture and deep soils maintain an excellent vegetative cover of dense lodgepole pine stands and lush grassy meadows. Forest habitat types are (in order of dominance) subalpine fir/grouse whortleberry, subalpine fir/dwarf huckleberry with pockets of subalpine fir/pinegrass. Water yield from this area is also quite uniform, ranging from 5 to 10 inches per year. Watershed conditions are very good and relatively stable under natural conditions over most of the area. Stream channels are mostly in good to excellent condition; however, streams in this area seem to carry a naturally high sediment load which is evidenced throughout the stream channels by the presence of numerous deposits of gravel and sand. In areas disturbed by grazing and man, stream reaches were found to be in fair to poor condition. These lands, because of their favorable topography, have relatively low hazards. However, management practices that disturb large areas of the soil surface could result in severe erosion and

sediment production. This would be particularly critical on the steeper slopes and on the Frost Churned Headlands Landtypes. Management alternatives on these lands should be carefully planned to consider their effect on the soft granitic bedrock material.

This unit contains extensive dense stands of lodgepole pine, but due to the cold climate and infertile soils, the productivity potentials are only low to moderate. This area is a very important elk summer range.

About 20 percent of the area along the western and eastern boundaries is strongly glaciated. These lands are the glaciated mountains that occur along the entire western boundary of the study area and in the Farrow Mountain, and Black Butte areas. These are typical alpine glaciated areas. Glacial troughs, cirques, cirque lakes, and steep rocky ridges are common. Elevations range from 7,500 to 10,000 feet. Slopes are long and very steep. Slope gradients range from 50 to 80 percent. Soils are coarse textured, stony, and shallow over most of the area. Vegetation on south aspects and at high elevations consists of very sparsely scattered subalpine fir, lodgepole pine, and whitebark pine over short brush and grass. At lower elevations on north and east aspects, dense conifer forests over tall brush are typical. Subalpine habitat types are dominant. This area is found at the highest elevations in the area and is at one extreme of the climatic conditions. The area has the highest average annual precipitation, 30 to 60 inches, coldest temperatures, deepest and longest lasting snowpacks, and accordingly, the shortest growing season. These lands yield 20 to 30 inches of runoff per year. Watershed and stream channel conditions are generally good for most of the area. Soil disturbing activities are particularly critical since the harsh climate makes revegetation extremely difficult. Productivity potentials are very low or low for most of the landtypes in this area. This physiographic area has very high scenic values for dispersed recreational use.

About 15 percent of the area located in the northern part of the subsection is in the middle and lower portions of the Chamberlain and McCalla Creek drainages. Topography is quite variable. Slopes are gentle and relief is low in the upper portion of the unit. Slopes are steeper and relief is much greater on the lower portion of this unit. Soils are coarse textured and are generally nonstony and deeper than 30 inches to soft, well weathered granitic bedrock. Vegetation at the higher elevations consists of fairly dense stands of ponderosa pine and Douglas fir over tall brush and grass. Much sparser stands of ponderosa pine and Douglas fir over scattered brush and grass are typical at lower elevations. Habitat type Douglas fir/pinegrass is predominant with Douglas fir/pinegrass snowberry, and Douglas fir/Idaho fescue. Nontimbered slopes are dominated by mountain big sagebrush/Idaho fescue and mountain big sagebrush/bluebunch wheatgrass. The steeper slopes result in a greater variation in the microclimate of this unit than in the basin portion of the area, with differences in aspect very noticeable. Annual precipitation averages about 20 inches.

Water yield from this area is approximately 1 to 5 inches per year. Watershed slopes adjacent to streams are steep and dry surface creep is actively moving material downslope. Stream channels are quite stable although heavy sediment loads are transported in them. This portion of the subsection contains the highest percentage of lands that have moderate and high timber productivity potential, along with low and moderate erosion and stability hazards of any of the physiographic areas. Some landtypes located on upper slopes and at higher elevations support good stands of ponderosa pine and Douglas fir timber. On these landtypes, many management practices such as logging and road building would not cause undue damage to soil and watershed values if carefully planned and the character of the soft granitic bedrock material is recognized. However, any soil disturbing activities on other landtypes could greatly damage soil and watershed values. These landtypes have steep slopes and are adjacent to the major streams. Any soil disturbance would result in sediment being carried directly into the stream channels. It is possible in many instances to develop a transportation system which would reach the productive timber areas without crossing these unstable landtype units.

Average annual precipitation for the entire area ranges from about 15 to 40 inches and runoff from 1 to 20 inches. The following shows the ranges in precipitation for 6- and 24-hour storms for selected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.4-1.8	
10	24	2.0-2.4	
25	24	2.4-3.0	2.2
10	6	1.1-1.4	
25	6	1.4-1.6	

A view of the eastern portion of the Salmon River Canyonlands Subsection (III-4).

Subsection 4 - Salmon River Canyonlands Subsection

The Salmon River Canyonlands Subsection comprises almost 1,000 square miles of entrenched canyonlands of the Salmon River (from North Fork) as well as the Middle Fork of the Salmon (to Norton Creek) and the South Fork of the Salmon (to the Secesh). In the land systems hierarchy, it is actually more like a landtype association but because of its large extent and rejuvenated characteristics, it is treated here as a subsection.

Anderson (1934) described the effects of the Snake River downwarp and the compensatory upwarp to the north and in 1947 discussed the reasons for drainage changes in the Salmon River and the stream piracy from the Missouri River of the Salmon and many of its tributaries to the Snake and Columbia Rivers (see geology appendix for discussion). The point is that structural changes causing diversion of so large amounts of runoff have been able to entrench themselves to great depth and maintain their courses even through subsequent periods of uplift. The result being that the Salmon River bisected what may have been, before uplift, a single "old erosion surface" to which the entire Salmon River Uplands Section is related. The important element of these canyonlands is not necessarily with their genesis but with their rejuvenated "oversteepened characteristics" where as many as 4 and 5 stream orders are skipped in slope hydrology. This skipping of stream orders is the one characteristic which increases rate of response to any impact or demand placed on most slopes in the area. For example, sediment delivered to a 1st order stream is oftentimes delivered to the Salmon River the first year and sometimes even during the same storm.

Bedrock in this subsection is of two basic types: high grade metamorphics on the east (mostly quartzites) and west (mostly schists) and the Idaho Batholith complex in the middle. Volcanics are common inclusions-Challis on the east and Columbia River on the west. Gneisses exposed in the eastern portion of the canyon have been identified as antecedent to the batholith (Precambrian). Some of the lands in this unit represent some of the highest, mass-movement hazard lands in the entire Province.

Soils in the area are variable and have strong relationship to the type and character of their parent material and vegetation.

Relief in this subsection is of the highest order (5,000 feet or more). Elevation at Riggins is about 1,800 feet to over 8,000 feet on some of the major peaks. Dominant relief however is about 4,000 feet. Live streams entrench the canyon walls on both sides at 1.5 to 2 mile intervals, which can be subdivided into three segments: First, the area west and down canyon from Lake Creek near Riggins. This area is largely unforested and dominated by bunchgrass communities and a few shrub types characteristic of the Pacific Northwest. Second, the main body of the Salmon River Canyon from Lake Creek to Fan Gulch near North Fork. In this

segment, the geology is largely granitic and the flora mixed, but generally similar to the communities occurring on the adjacent Idaho Batholith with inclusions of plants and some community types from the Pacific Northwest. Third, the remaining segment from Fan Gulch to North Fork. In this segment the geologic bedrock is largely sedimentary and volcanic, and the plant communities are characteristic of those found in the Great Basin.

The predominant communities found in the segment below Lake Creek are the bluebunch wheatgrass/Idaho fescue, bluebunch wheatgrass/sandberg bluegrass with three/sandberg bluegrass, and sand dropseed/sandberg bluegrass occurring on certain distinct soil conditions. Minor shrub communities include the hackberry/cheatgrass, sumac/bluebunch wheatgrass, sumac/sand dropseed and the sumac/three own types. On mesic north facing slopes ponderosa pine/Idaho fescue and ponderosa pine/ninebark may be found. Greasebush and curlleaf mountain mahogany occur on rock outcrop and scree.

On the second segment of the river from Lake Creek to Fan Gulch, a wide variety of ponderosa pine and Douglas fir types are found intermixed with the bluebunch wheatgrass/Idaho fescue type and some greasebush and curlleaf mountain mahogany.

The predominant ponderosa pine types include the ponderosa pine/bluebunch wheatgrass, ponderosa pine/Idaho fescue and some ponderosa pine/ninebark. Abandoned agricultural land on some of the river terraces and benches are being invaded by ponderosa pine.

The predominant Douglas fir types are the Douglas fir/ninebark, Douglas fir/Idaho fescue, Douglas fir/pinegrass with some remnants of the Douglas fir/snowberry, Douglas fir/elksedge and Douglas fir/spiraea.

Several remnant pockets of the grand fir/queencup habitat type occur in mesic sites along the river.

A few sites on north slopes in the easternmost part of this river segment are occupied by subalpine fir/common snowberry and subalpine fir/grouse whortleberry.

A number of river bottom alder, birch and cottonwood types occur throughout the length of the river.

The predominant vegetation in the river segment from Fan Gulch to North Fork is sagebrush grass and bunchgrass. The dominant types are the big sagebrush/bluebunch wheatgrass and the bluebunch wheatgrass/sandberg bluegrass types. A few north aspects are occupied by ponderosa pine and/or Douglas fir.

A complex of river bottom types include willow, cottonwood and meadow grassland communities.

Average annual precipitation ranges dominantly from 15 to 25 inches and runoff from 5 to 15 inches. Figure 1 shows the ranges in precipitation which can be expected from 6- and 24-hour duration storms at selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions on eastern end
2	24	1.2-1.8	1.0
10	24	2.0-2.8	1.6 & 1.8
25	24	2.0-2.6	1.8
10	6	1.1-1.4	
25	6	1.3-1.6	

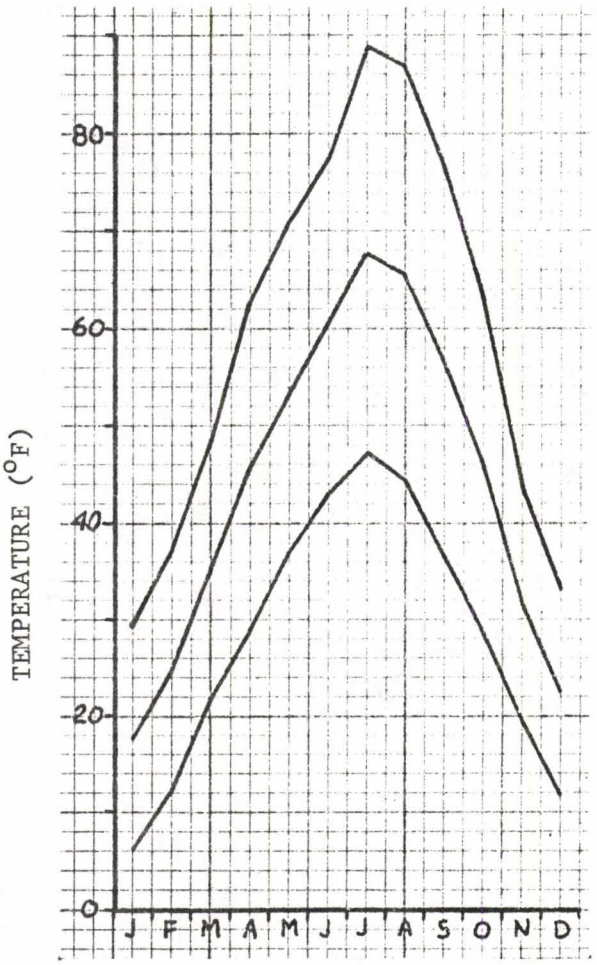
The challenges to management of this unit are essentially tied to severe limitation of stability and in many cases maintaining adequate cover for watershed protection, wildlife habitat and for maintenance of Wild River characteristics (where applicable).

Figures 2 through 5 show the tendencies of precipitation and temperatures to decrease from west to east.

Figure 2

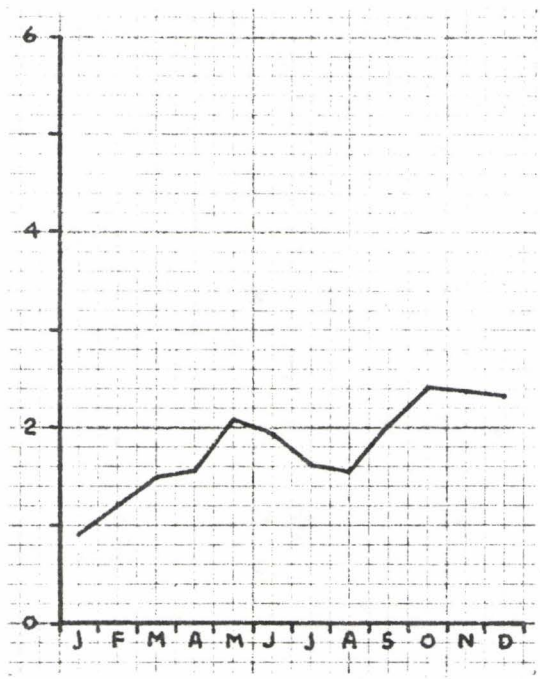
RIGGINS R.S.
ELEV. = 1840
YEARS = 23
66.5-54.1-41.7

Figure 3



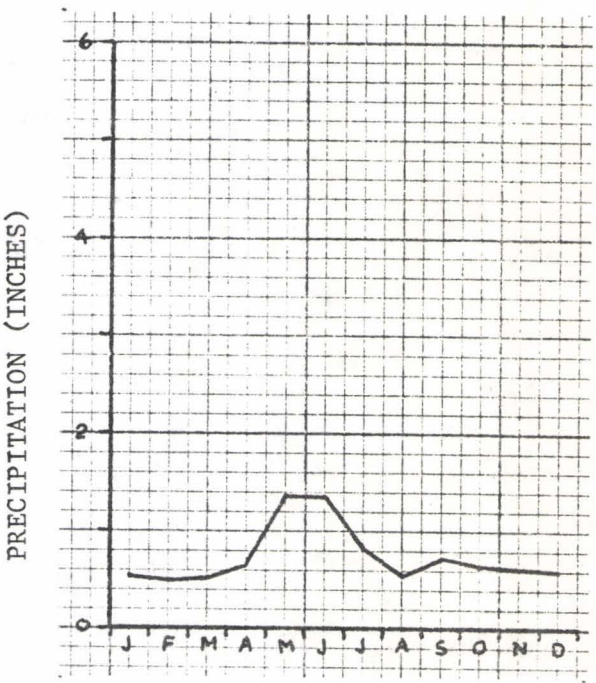
SALMON
ELEV. = 3949
YEARS = 30
59.9-44.0-28.1

Figure 4

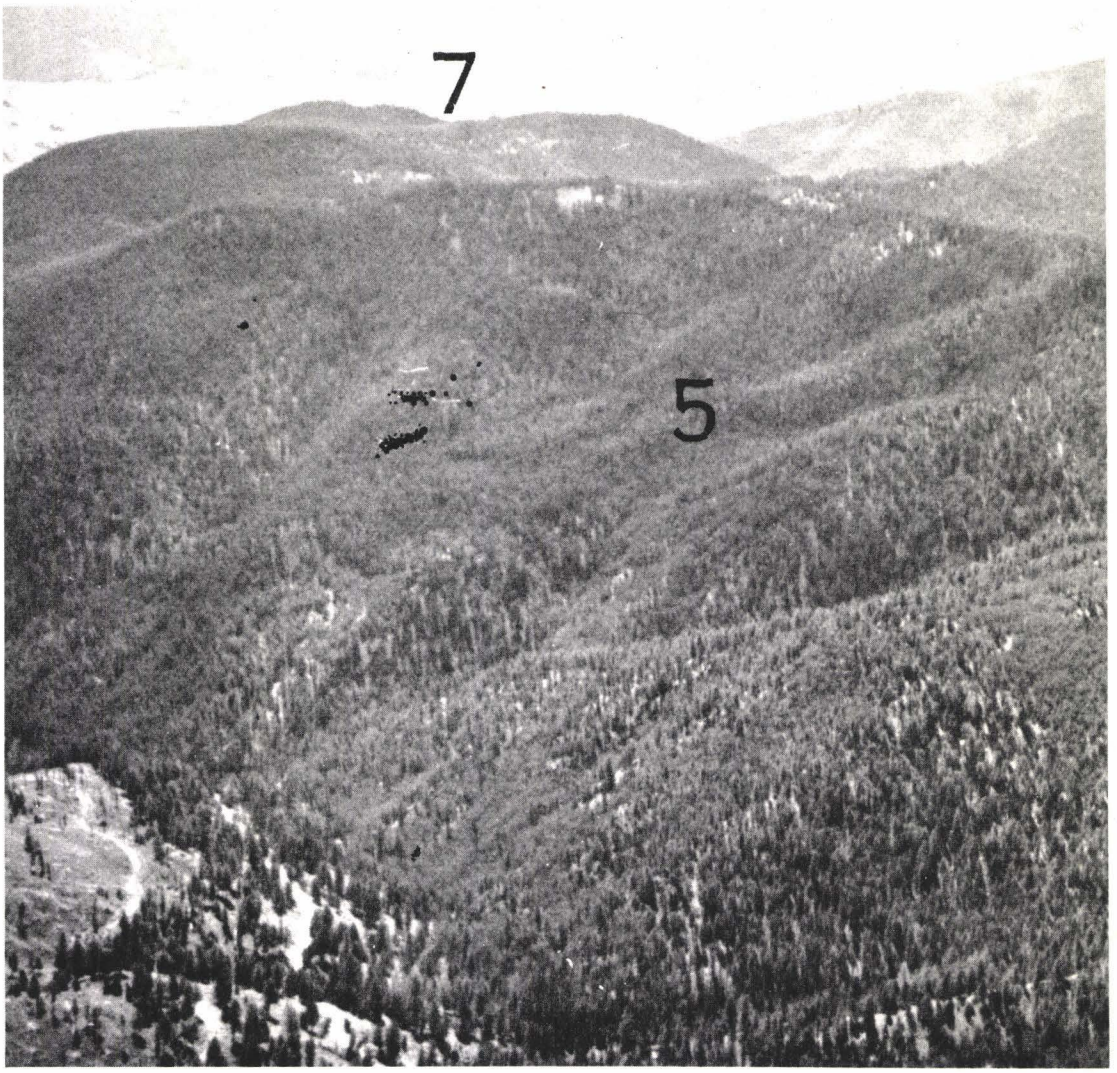


RIGGINS R.S.
ELEV. = 1840
YEARS = 30
A.A.P. = 15.46

Figure 5



SALMON
ELEV. = 3949
YEARS = 30
A.A.P. = 3.93



Looking across eastern portion of Big Horn Crags (III-5). The southern portion of Panther Creek Basin Uplands (III-7) is in middle background.

Subsection 5 - Big Horn Crags Subsection

The Big Horn Crags Subsection occupies about 140,000 acres immediately south and east of the Salmon River Canyonlands at the confluence of the Middle and Main Forks of the Salmon River. The area ranges in elevation from about 6,000 feet in the entrenched drainages like Clear Creek, Big Deer Creek, Yellow Jacket Creek, Wilson Creek and Roaring Creek to a high of over 10,000 feet at Mount McGuire. The area is dominated in the interior by a strongly glaciated summit ranging mainly 7,500 to 9,000 feet. A similar area, which is considered an inclusion of the Chamberlain Basin Subsection, about 30,000 acres in extent, lies across the Middle Fork of the Salmon to the northwest of the center of the Big Horn Crags area.

Bedrock in the area is diverse with rocks of the Belt Super Group dominating the area on the east with batholith granitics dominating a large area centering around Cathedral Rock. High angle jointing has produced peaks and cliffs. Well weathered granitic knobs surrounded by creep grus are observed at the higher elevations indicating that these lands were above the zone of glaciation that so greatly affected the lower elevations. The belt rocks are dominantly quartzites, belt, schists, and phyllites also occur. Soil characteristics vary with parent materials, degree of glaciation, position on slope and other factors.

Except for a few Steep Dissected Fluvial slopes and scattered Smooth to Moderately Dissected Frost Churned (cryic) slopes, the area is chiefly composed of alpine glaciated landforms, cirques, troughs, rocky ridgelands, and valley trains. Coarse textured, shallow, stony soils dominate the rocky ridgelands and glacial troughs and the steeper fluvial lands. Moderately deep and deep, moderately coarse textured, less stony soils are found in some cirques and cryic uplands and slopes.

The highest elevations are dominated by the whitebark pine barren zone. In the wetter streamside and lakeside areas, the wet meadow-sedge complex is dominant with some red mountain health/western ledum. At mid-to-high elevations subalpine fir/grouse whortleberry is the predominant type with some pockets of subalpine fir/beargrass and subalpine fir/bluejoint wheatgrass. Douglas fir/ninebark occurs on toe slopes at lower elevations. The predominant Douglas fir type is the Douglas fir/pinegrass with minor areas of Douglas fir/elksedge. Along the western boundary of the subsection in the Middle Fork of the Salmon River, ponderosa pine/Idaho fescue and ponderosa pine/common snowberry are found. Nontimbered open slopes contain bluebunch wheatgrass/Idaho fescue.

Average annual rainfall ranges from about 25 to 40 inches and runoff from 10 to 30 inches. The following shows the ranges in precipitation for 6- and 24-hour storms which can be expected for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.6-1.8	1.4 & 2.0
10	24	2.4-2.6	2.2 & 2.8
25	24	2.2-3.2	
10	6	1.4-1.5	1.6
25	6	1.6-1.7	1.8

Most of this subsection lies in the proposed Idaho Wilderness Area. The Big Horn Crags constitute some of the highest wilderness values. Because of the extremely sensitive nature of the soils and vegetation of the high elevation areas, maintaining the quality of wilderness will be difficult in the years ahead.

Looking into Panther Creek Canyonlands
Subsection (III-6) across Salmon River Canyon.

Subsection 6 - Panther Creek Canyonlands Subsection

The Panther Creek Canyonlands Subsection occupies about 80,000 acres of the lower Panther Creek drainage. It ranges in elevation from about 4,000 to 8,000 feet. Over 75 percent of the area lies between 5,000 and 7,500 feet. Slopes are steep to precipitous. Many slopes with southerly aspects support few or no trees.

Bedrock is varied, ranging from the gneisses of the "Border Zone" rock to granitics of the batholith to quartzites and phyllites of the Belt Super Group.

About 55 percent of the area is in the Granitic Fluvial Landtype association. These lands occur primarily in the midslope area between the Steep Canyonlands and the Frost Churned Uplands. Elevations range between 4,000 and 7,000 feet. The primary slope forming process has been the movement of water downslope. The soils are coarse textured gravelly sand and gravelly sandy loams. The erosion hazard is moderate to high. High intensity storms may cause serious mud-rock flows especially where rock outcrops collect and disperse the water onto the soil below. Water tends to gully road surfaces in these lands. Ponderosa pine is the primary tree species on hot aspects with Douglas fir occurring on the cool aspects. The primary habitat type seems to be ponderosa pine/wheatgrass and Idaho fescue and Douglas fir/pinegrass-elksedge.

About 25 percent of the area is in the Granitic Steep Canyonlands Landtype association. These lands occupy the extremely steep slopes immediately adjacent to the Salmon River and its tributaries in the Idaho Batholith. Slopes range from 50 percent to 90 percent and are generally 70 percent or more. Soils are very shallow and coarse textured. Rock outcrops and cliffs are common. South aspects are generally hot, dry and sparsely vegetated dominated by bluebunch wheatgrass/Idaho fescue. North aspects are cooler and may contain commercial timber stands. Douglas fir habitat types are most common here. These lands are often geologically unstable. Erosion and mass failure hazards are very high (north slopes are more stable than south slopes).

Soil disturbing activities would greatly damage watershed values. These lands are important big game winter range. The highest elevations of these lands are smooth to moderately dissected frost churned lands. Soils on these lands are moderately deep to deep and have subalpine habitat types.

About 10 percent of the area is in the Quartzite Fluvial Landtype association. These lands occur at elevations between 4,000 and 7,000 feet. The primary slope forming process has been the movement of water downslope. The ridges are sharp and the valleys are V-shaped. Slopes are generally from 45 to 70 percent. The soils are medium to coarse textured, gravelly sandy loams and gravelly loams.

The erosion hazards are low to moderate. Roads built on these soils are stable, requiring low maintenance and can be used year around. Douglas fir is the primary tree species with some intermixing of ponderosa pine. The primary habitat types seem to be Douglas fir/pinegrass and Douglas fir/ninebark. Water generally moves downslope via subsurface flow but overland flow can occur on steep slopes during peak periods.

Approximately 10 percent of the area is about equally split between Granitic Frost Churned (cryic) Uplands and Quartzite Frost Churned (cryic) Uplands. The Granitic Uplands occur at elevations greater than 7,000 feet. The dominant slope forming process has been frost action. These lands occur commonly along ridgetops. Ridges are rounded and draws are concave. Slopes are less than 50 percent.

Soils are coarse textured, gravelly and cobbly throughout the profile. These soils are porous and well-drained. Overland flow is rare. Soil temperatures are cold, growing seasons are short and productivity levels and revegetation potentials are lower than in the granitic fluvial lands. Common habitat types are subalpine fir/grouse whortleberry, subalpine fir/beargrass, and Douglas fir/pinegrass.

Erosion hazards are generally low to moderate although seeps and springs can present problems. These lands are generally among the better sites for transportation systems in the granites.

The Quartzite Uplands occur along ridgetops and high divides. They are generally at elevations greater than 7,000 feet. They are characterized by cold climate, short growing season, rounded ridges and gentle slopes (less than 50 percent). The dominant slope forming process has been frost action.

Soils are medium textured, gravelly and cobbly. They are generally well drained. Overland flow is rare. Soil temperatures are cold and productivity levels and revegetation potentials are lower than in the Quartzite Fluvial Lands. Most common habitat types are subalpine fir/grouse whortleberry and Douglas fir/pinegrass.

Erosion hazards are very low to low with springs and seeps causing local problems. These lands are usually very stable road locations.

Small portions of the lower open slopes are dominated by bluebunch wheatgrass/Idaho fescue. This type grades into Douglas fir and ponderosa pine/Idaho fescue. Better soil sites on protected toe slopes are occupied by Douglas fir/ninebark. Douglas fir/pinegrass is the dominant and most extensive habitat type in the subsection. This type grades into the subalpine fir/pinegrass with some pockets of subalpine fir/grouse whortleberry, subalpine fir/beargrass and subalpine fir/elksedge in suitable sites as inclusions. The whitebark pine barren zone occurs at the highest elevations in this subsection.

Average annual precipitation ranges from 20 to 35 inches and runoff from 1 to 10 inches. The following shows the ranges in precipitation for 6- and 24-hour storms that can be expected for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.2-1.6	
10	24	1.8-2.6	2.8
25	24	2.2-2.8	
10	6	1.1-1.4	
25	6	1.3-1.4	

The chief management considerations are in the development of adequate road nets to reach commercial timber while giving adequate protection to watershed, wildlife and other resources.

Northern portion of Panther Creek Basin (III-7) Subsection.

Subsection 7 - Panther Creek Basin and Uplands Subsection

The Panther Creek Basin and Uplands Subsection occupies about 300,000 acres near the southeastern boundary of the Salmon Uplands Section. Elevations range from about 5,000 to above 9,000 feet, but over 80 percent of the area lies between 6,000 to 8,000 feet. Dominant relief ranges from about 800 to 1,500 feet. The area is characterized by smooth undulating slopes and broad rolling ridges and uplands. The northern portion is mainly timbered. The treeless feature of the uplands in the vicinity of Forey in the southern portion of the area is unique to the whole Salmon Uplands Section. Challis volcanics dominate in this portion of the area. Other bedrock in the area includes quartzites and granitics with lesser amounts of phyllites and schist. Some of the drainage bottoms contain lake sediments. The area is in a highly mineralized zone and considerable mining activity has taken place in the recent past and reduction of pollution from these activities is a major challenge.

This subsection contains many features of a Pliocene erosion surface (Shockey, 1957) modified by pre-Wisconsin and Wisconsin glaciation. The ice of the earlier glacial period was up to 2,000 feet thick and generally covered most of the area. Melt water from this glacier entrenched some of the major canyons. Cirque development above 8,000 feet, however, was accomplished by later glaciation. Most of the landscape has strong frost churned characteristics typical of cold region zones.

The following table shows the distribution of landtype associations in the area:

Land Type Association	Approximate Proportion (%)
Steep Canyonlands (Quartzite and Granitic)	10
Quartzite Fluvial Lands	10
Volcanic Fluvial Lands	1.5
Quartzite Frost Churned (cryic) Lands	25
Volcanic Frost Churned (cryic) Lands	5
Granitic Frost Churned (cryic) Basin Lands	1.0
Quartzite Frost Churned (cryic) Basin Lands	1.5
Strongly Glaciated Trough Lands (Granitic-Quartzite)	1.0

General descriptions of these associations are as follows:

Granitic Steep Canyonlands occupy the extremely steep slopes immediately adjacent to the Salmon River and its tributaries in the Idaho Batholith. Slopes range from 50 to 90 percent and are generally 70 percent or more. Soils are very shallow and coarse textured. Rock outcrops and cliffs are common. South aspects are generally hot, dry and sparsely vegetated. North aspects are cooler and may contain commercial timber stands.

Douglas fir habitat types are most common here. These lands are often geologically unstable. Erosion and mass failure hazards are very high (north slopes are more stable than south slopes).

Soil disturbing activities would greatly damage watershed values. These lands are important big game winter range.

Quartzite Steep Canyonlands are the very steep slopes immediately adjacent to the Salmon River and its tributaries in quartzite geology. Slopes range from 50 to 90 percent and are generally 70 percent or more. Soils are often shallow and medium to coarse textured. South aspects are generally dry and sparsely vegetated with ponderosa pine/wheatgrass being a common habitat type. North aspects are cooler and often contain commercial stands of timber. Douglas fir habitat types are most common. Mass failure hazards are medium and erosion hazards are generally medium. These lands are more stable than their granitic counterparts but soil disturbing activities are still potentially hazardous because of the streams immediately below. These lands are important big game winter range in many cases.

Quartzite Fluvial Lands occur at elevations between 4,000 and 7,000 feet. The primary slope forming process has been the movement of water downslope. The ridges are sharp and the valleys are V-shaped. Slopes are generally from 45 to 70 percent. The soils are medium to coarse textured, gravelly sandy loams and gravelly loams. The erosion hazards are low to moderate. Roads built on these soils are stable, requiring low maintenance, and can be used year around. Douglas fir is the primary tree species with some intermixing of ponderosa pine. The primary habitat types seem to be Douglas fir/pinegrass and Douglas fir/ninebark. Water generally moves downslope via subsurface flow but overland flow can occur on steep slopes during peak periods.

Volcanic Fluvial Lands occur primarily on the foothills in the southern half of the lower portions of the mountain slopes. The slope forming process has been the movement of water downslope. Ridges are rounded and the valleys tend to have bigger flood plains than the valleys in the quartzite and granitics. The erosion hazard is moderate to high. Roads built in these areas will be very slick during wet periods and will be usable only during dry seasons. The slump hazard is high especially on road cuts that intercept wet areas or springs. The major tree species is Douglas fir. Douglas fir in these lands seems to be more highly susceptible to mistletoe infestation than in other areas.

Quartzite Frost Churned (cryic) Lands occur along ridgetops and high divides. They are generally at elevations greater than 7,000 feet. They are characterized by cold climate, short growing season, rounded ridges and gentle slopes (less than 50 percent). The dominant slope forming process has been frost action.

Soils are medium textured, gravelly and cobbly. They are generally well drained. Overland flow is rare. Soil temperatures are cold and productivity levels and revegetation potentials are lower than in the Quartzite Fluvial Lands. Most common habitat types are subalpine fir/grouse whortleberry and Douglas fir/pinegrass.

Erosion hazards are very low to low with springs and seeps causing local problems. These lands are usually very stable road locations.

Volcanic Frost Churned (cryic) Lands generally occur at elevations greater than 7,000 feet. The dominant slope forming process has been frost churning. These lands occur along ridgetops. The ridges are rounded and the slopes are convex. Slopes are less than 50 percent. Soils are clay loams to loamy clays. Soil temperatures are cold. Much of the water is handled by overland flow. Roads built on these soils will be slick and use will be limited to dry seasons. Erosion hazards are moderate to high. The land slump hazard is high especially where road cuts intercept springs. In the Silver Creek and Porphyry Creek areas, the volcanic rocks are rhyolite, which is similar to granite in mineral composition. The hazards and potentials of these areas are similar to the Granitic Cryoplanated Uplands. The tree species are Douglas fir, subalpine fir, and lodgepole pine.

Granitic Frost Churned (cryic) Basin Lands occur in the Moose Creek and Leesburg areas at elevations greater than 6,000 feet. Frost churning along with fluvial action has been the slope forming processes. This unit is characterized by an incised dendritic drainage pattern with rounded ridgetops, convex slopes, and concave drainage bottoms. Slope gradients range from 20 to 60 percent. Overland flow is rare and subsurface flow is slowly concentrated in drainageways. Soils are fine sandy loam and sandy loam. These soils, when exposed to surface runoff during the spring, will erode if the vegetation is removed. However, due to the low relief, this area will be subject to less erosion hazard than the granitic fluvial slopes.

Roads built on these lands should be stable if the roads are built along the ridges with proper drainage. The primary tree species is lodgepole pine.

With Quartzite Frost Churned (cryic) Basin Lands, frost churning and fluvial action have been the slope forming processes. The ridgetops are less rounded and drainages more V-shaped than the Granitic Cryoplanated Basin Lands. Slope gradients range from 20 to 60 percent. Soils are gravelly fine sands to gravelly sandy loams.

The erosion hazard of these soils is low. Roads built on these lands should be stable and require a minimum of maintenance. The regeneration potential of lodgepole seems to be very high on these lands in comparison to the Granitic Cryoplanated Basin Lands. The major tree species is lodgepole pine with some Douglas fir.

Strongly Glaciated Trough Lands (granitic quartzite) often lie immediately adjacent to Strongly Glaciated Quartzite Lands and are dominated by the long, U-shaped valleys carved by the glacial "tongues" which crept down out of the high country. These troughs have steep (45 to 70 percent) sideslopes and broad, gently sloping valley bottoms. On the sideslopes, soils are shallow to moderately deep, medium to coarse textured and cobbly. Erosion hazards are medium. Snowslide hazards are high.

The valley bottoms are generally more stable and well drained but the high runoff from the adjacent glaciated lands and heavy subsurface flow could lead to road washouts and other related problems due to interception of flow. These lands often support commercial stands of timber but the cold climate limits revegetation success. Care must be taken not to disturb large amounts of vegetation in these troughs.

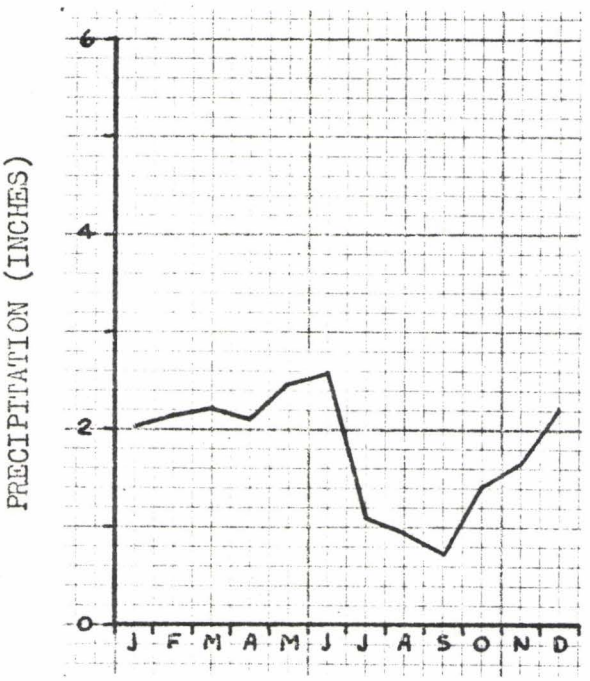
Some open lower elevation south slopes within this subsection are dominated by bluebunch wheatgrass/sandberg bluegrass and bluebunch wheatgrass/Idaho fescue. These two types grade into ponderosa pine and Douglas fir/Idaho fescue and some bluebunch wheatgrass. On more coarsely textured soils, ponderosa pine/bitterbrush can be found. Both Douglas fir/ninebark and Douglas fir/common snowberry can be found on dryer soils at lower elevations. The predominant Douglas fir habitat type is the Douglas fir/pinegrass. This type grades into the subalpine fir/grouse whortleberry type at higher elevations and on cooler aspects. Some pockets of subalpine fir/tall huckleberry and subalpine fir/beargrass occur particularly on the north end of the subsection. The whitebark pine barren zone occurs above these types at the highest elevations in the subsection.

Average annual precipitation ranges from 25 to 35 inches and runoff from 5 to 20 inches. Figure 1 shows the range in precipitation that can be expected for 6- and 24-hour storms for selected storm interval periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.4-1.6	
10	24	1.8-2.4	2.6
25	24	2.4-2.8	
10	6	1.1-1.4	
25	6	1.4-1.5	

Figures 2 and 3 show the distribution of precipitation and the average monthly maximum, mean, and minimum temperatures for Cobalt-Blackbird mine.

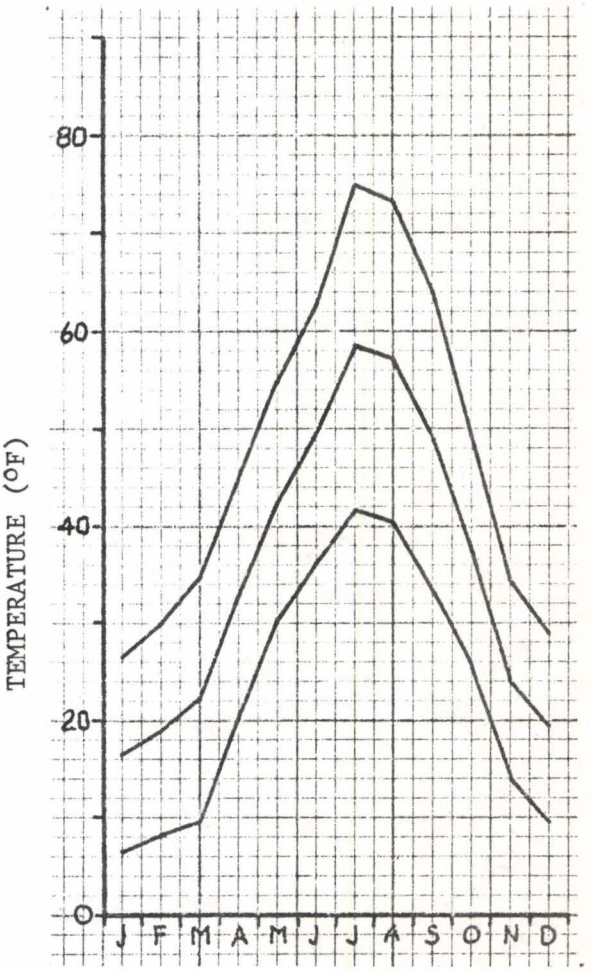
Figure 2



MONTHS

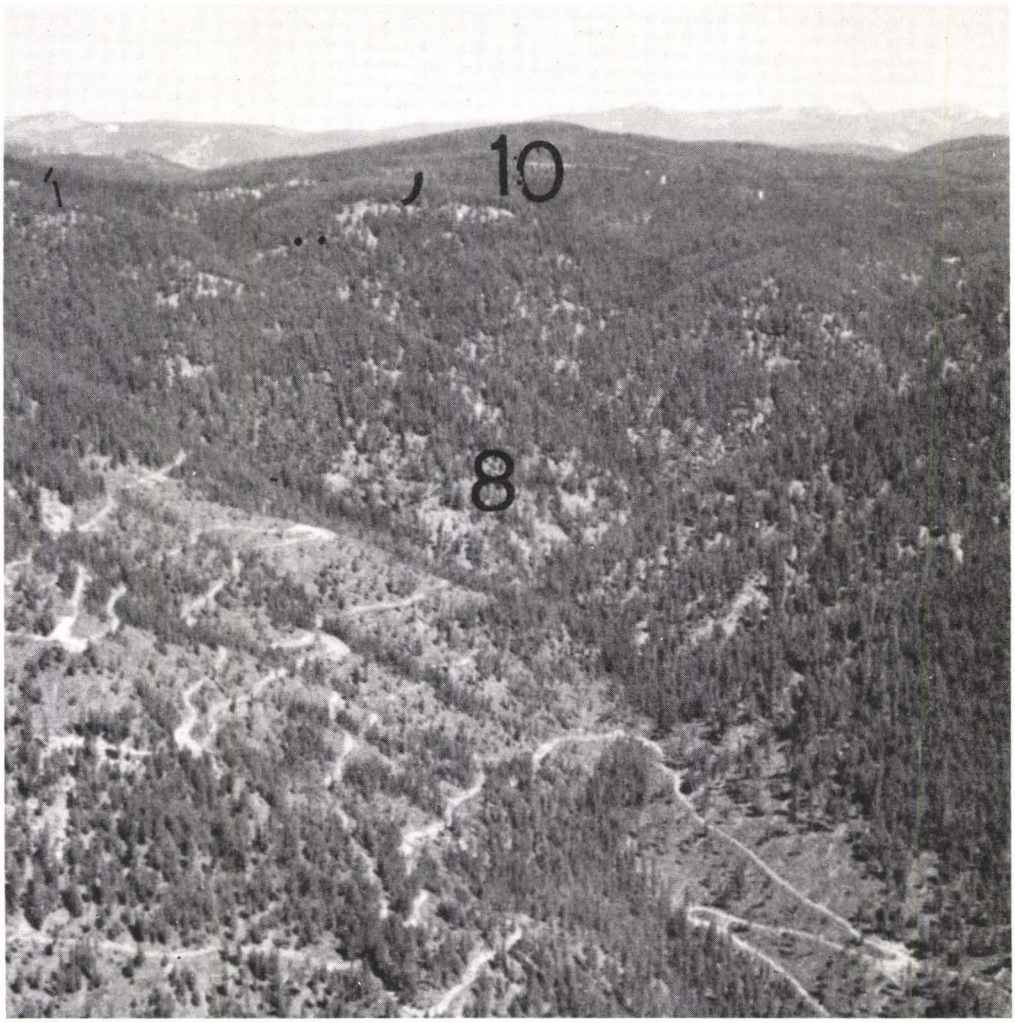
COBALT BLACKBIRD MINE
ELEV. = 6810
YEARS = 9
A.A.P. = 21.65

Figure 3



MONTHS

COBALT BLACKBIRD MINE
ELEV. = 6810
YEARS = 9
48.2-35.7-23.0



Looking north across North Fork Salmon Breaks Subsection (III-8) in foreground into State Divide Uplands Subsection (III-10) in the near background.

Subsection 8 - North Fork Salmon Breaks Subsection

The North Fork Salmon Breaks Subsection is a relatively small area, about 80,000 acres, which occupies the headlands above the Salmon River Canyonlands and below the Idaho-Montana State divide uplands roughly between Horse Creek and the canyonlands of the North Fork of the Salmon River. The area contains some of the canyonlands and headlands of Horse Creek, Owl Creek, Boulder Creek, Spring Creek, Indian Creek, Sage Creek and Hughes Creek. Elevations range from about 4,500 to over 8,000 feet. Dominant local relief ranges from about 1,500 to 2,500 feet. Except for the extreme eastern portion, bedrock in the area consists mainly of undifferentiated granitic and grussic rocks, many of which are very coarse grained (porphoritic). Most are in weathering classes 3 and 4, but some slopes are underlain by weathering class 5 rocks. Bedrock in the western-most portion is mainly quartzite.

About 10 percent of this unit is occupied by an extension of the Salmon River Canyonlands, chiefly Granitic Steep Canyonlands. These lands are the extremely steep slopes immediately adjacent to Horse, Owl, Boulder, Squaw, and Indian drainages. Slopes range from 50 to 90 percent and are generally 70 percent or more. Soils are very shallow and coarse textured. Rock outcrops and cliffs are common. South aspects are generally hot, dry and sparsely vegetated. North aspects are cooler and may contain commercial timber stands. Douglas fir habitat types are most common here.

These lands are often geologically unstable. Erosion and mass failure hazards are very high (north slopes are more stable than south slopes). Soil disturbing activities would greatly damage watershed values. These lands are important big game winter range.

About 10 percent of the area (in the easternmost portion) consists of Quartzite Fluvial Lands. These lands occur at elevations mainly between 5,000 and 6,500 feet. The primary slope forming process has been the movement of water downslope. The ridges are sharp and the valleys are V-shaped. Slopes are generally from 45 to 70 percent. The soils are medium to coarse textured, gravelly sandy loams and gravelly loams. The erosion hazards are low to moderate. Roads built on these soils are stable, requiring low maintenance, and can be used year around. Douglas fir is the primary tree species with some intermixing of ponderosa pine. The primary habitat types seem to be Douglas fir/pinegrass and Douglas fir/ninebark. Water generally moves downslope via subsurface flow but overland flow can occur on steep slopes during peak periods.

About 70 percent of the area consists of Granitic Fluvial Lands. Elevations range between 5,000 and 7,000 feet. The primary slope forming process has been the movement of water downslope. The soils are coarse textured gravelly sandy and gravelly sandy loams. The erosion hazard is moderate

to high. High intensity storms may cause serious mud-rock flows especially where rock outcrops collect and concentrate the water onto the soil below. Water tends to gully road surfaces in these lands. Ponderosa pine is the primary tree species on hot aspects with Douglas fir occurring on the cool aspects. The primary habitat type seems to be Ponderosa pine/wheatgrass and Idaho fescue and Douglas fir/pinegrass/elksedge.

About 10 percent of the area, mostly above 6,500 feet, consists of Granitic Frost Churned (cryic) Uplands. The dominant slope forming process has been frost action. These lands occur commonly along ridgetops. Ridges are rounded and draws are concave. Slopes are less than 50 percent. Soils are coarse textured, gravelly and cobbly throughout the profile. These soils are porous and well-drained. Overland flow is rare. Soil temperatures are cold, growing seasons are short and productivity levels and revegetation potentials are lower than in the Granitic Fluvial Lands. Common habitat types are subalpine fir/grouse whortleberry, subalpine fir/beargrass, and Douglas fir/pinegrass. Erosion hazards are generally low to moderate although seeps and springs can present problems. These lands are generally among the better sites for transportation systems in the granites.

Along the southern border of this subsection, ponderosa pine and Douglas fir/Idaho fescue are the dominant habitat types with interfingering of Douglas fir/common snowberry and Douglas fir/ninebark on the more moist sites. These types grade into Douglas fir and subalpine fir/beargrass at higher elevations and on cooler sites, and with some pockets of Douglas fir/pinegrass and grand fir/queencup occurring on suitable sites. At the highest elevations in the subsection, subalpine fir/grouse whortleberry is the dominant vegetation type.

Average annual precipitation ranges from 20 to 30 inches and runoff from 5 to 15 inches. The following shows the range in precipitation that may be expected for 6- and 24-hour storms at selected expected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.4-1.6
10	24	1.6-2.6
25	24	2.6-3.0
10	6	1.1-1.4
25	6	1.4-1.5

Challenges to management mainly involve access development and timber harvesting within the constraints imposed by slope stability characteristics and other values like scenic and fish and wildlife management objectives.

Subsection 9 - West Fork Bitterroot Streamcut Subsection

The West Fork Bitterroot Streamcut Subsection consists of about 240,000 acres of the western headwaters of East and West Forks of the Bitterroot River. The areas range from about 5,000 to 8,800 feet. Dominant local relief ranges from about 1,500 to almost 3,000 feet. About 20 percent of the area is above 7,000 feet and less than 5 percent above 8,000 feet. The rest of the area is about equally split between lands of 5,000 and 6,000 feet and 6,000 and 7,000 feet.

Over 75 percent of the area has granitic bedrock with a wide range of mineralogical composition and apparent age (see Winegar, 1974 Report). An important inclusion in these rocks is a more recent shallow intrusion of felsitic rocks (mainly quartz latite).

Several small islands and one large island of volcanic rocks (chiefly ryolitic) are disturbed throughout the area except for the northeastern half. These constitute about 10 percent of the area. The remaining 15 percent of the area lies in quartzites (including some gneisses and phyllites).

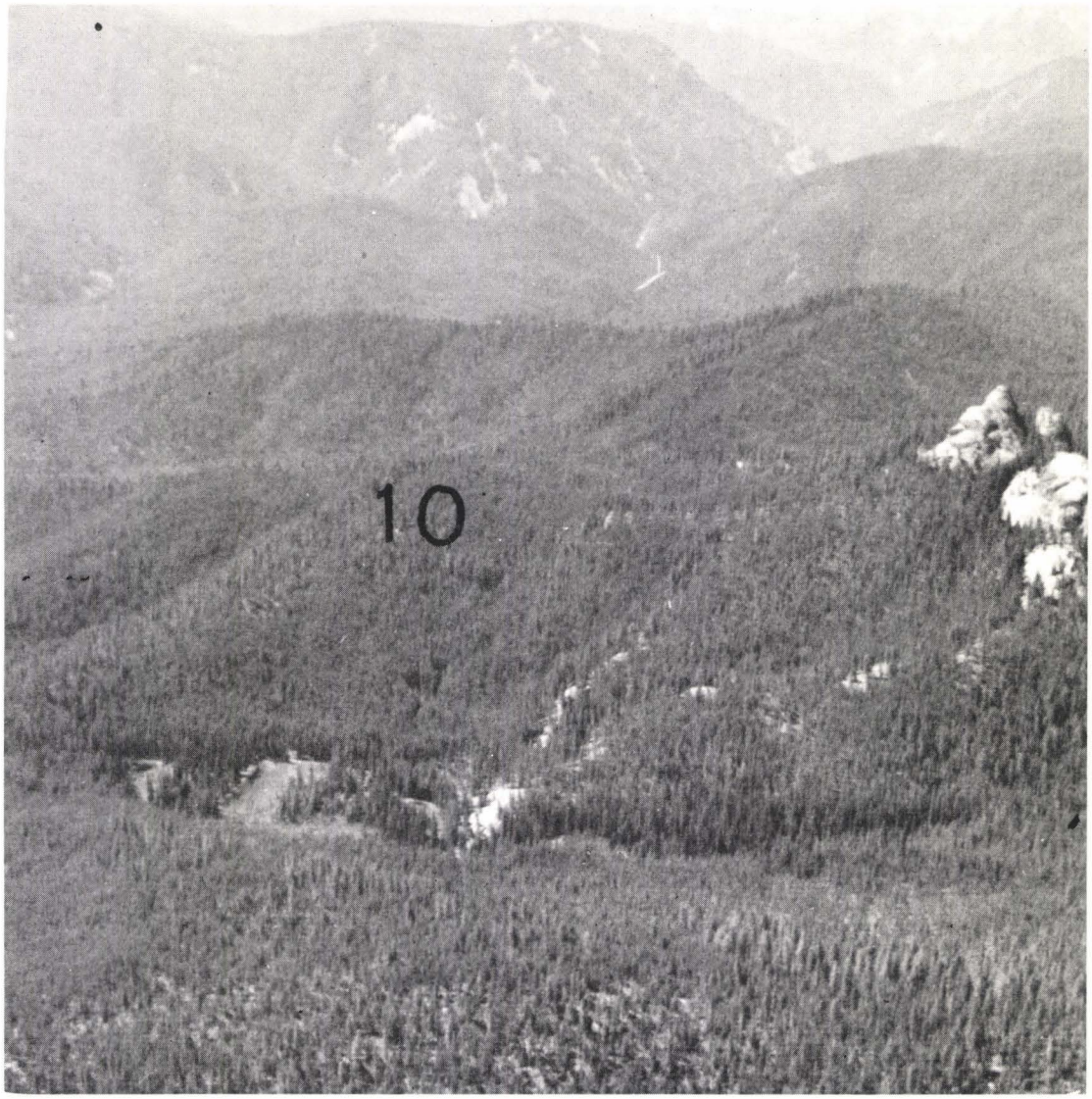
About 60 to 75 percent of the area can be ascribed to the Weakly to Moderately Dissected Fluvial Lands. On slopes with deep, stony soils, especially when bedrock is highly fractured and rock fragments very competent, it is difficult to ascertain slopes in the Frost Churned Landtype association from colluvial slopes in the Fluvial Land associations. These differences are somewhat academic since they both have similar slope hydrologies and have very little surface runoff from even large storms. About 15 to 20 percent is in the Frost Churned (cryic) Landtype associations. These slopes generally lie between 7,000 and 8,000 feet and occupy the broad ridges, saddles and gentle headlands.

Soils are dominantly moderately coarse textured throughout most of the area. The area soils are moderately deep to deep on most Frost Churned Slopes and some smooth colluvial quartzite slopes. Stoniness varies but is generally more stony where rock is most fractured and competent as in some of the quartzites and rhyolites. Soils are shallow to moderately deep on the steep well-dissected fluvial lands and on the scattered rocky knobs.

Habitat types are dominantly subalpine fir/beargrass on northerly intermediate (6,500 feet) slopes to higher elevations (7,000 to 8,000 feet) on all aspects. Douglas fir/beargrass is on north facing slopes at 5,000 to 6,500 feet. Douglas fir/pinegrass is on south facing slopes dominantly below 6,500 feet with Douglas fir/snowberry just above this elevation.

Subalpine fir/woodrush occurs above 8,000 feet and subalpine fir/menziesia in high draws. Other common inclusions are Douglas fir/Agsp and Douglas fir/ninebark.

Average annual precipitation ranges from about 20 to 40 inches and runoff from about 5 to 20 inches.



Looking across typical landtypes in the State Divide Uplands Subsection (III-10) in House Creek drainage toward Salmon River Canyon Lands.

Subsection 10 - State Divide Uplands Subsection

The State Divide Uplands Subsection consists of about 135,000 acres comprising the headwaters of the West Fork of the Bitterroot and Blue Joint drainages on the Montana side and the headwaters of the main drainages above the Salmon River from Horse Creek to Hughes Creek on the Idaho side. The area ranges in elevation from about 5,500 feet to about 8,500 feet. It has two distinct sets of relief, however. The rolling ridge lands in the western and central portion of the area have a dominant relief of about 1,000 feet. The main drainages and the eastern portion of the unit have a dominant relief of 1,500 to 2,000 feet.

About 70 percent of the area is above 7,000 feet, but less than 50 percent of the area is above 8,000 feet; consequently about 25 percent of the area is below 7,000 feet.

In this area, these elevational breaks approximate the rough distribution of the main landtype associations: Frost Churned Slopes and Uplands (70%), Strongly Glaciated Alpine Lands (5%), and Strongly to Moderately Dissected Fluvial Lands (5%), Depositional Lands in the valleys occupy 25% of the area.

The bedrock in about half the area consists of rocks of the Belt Super Group, most of which are quartzites, phyllites and gneisses. The southwestern portion of the area is chiefly granitics and the northwestern corner of the area is mainly volcanics (chiefly rhyolitic).

Soils are dominantly deep and moderately coarse textured on most of the Frost Churned Uplands and Slopes and generally stony in the quartzite and rhyolite areas. Soils are generally shallow to moderately deep on the Fluvial Slopes and shallow in the Strongly Glaciated Lands.

Dominant habitat types are subalpine fir/beargrass (about 35%), Douglas fir/beargrass (about 25%), subalpine fir/woodrush (about 5%), which occupy moist sites at upper elevations and subalpine fir/menzesia (about 10%) in draws at 6,000 to 7,000 feet elevations. Subalpine fir/whitebark barrens occupy the highest elevations.

Average annual precipitation is about 35 to 45 inches and runoff from 10 to 30 inches. The following shows the range in precipitation that can be expected from 6- and 24-hour storms for selected expected return frequencies.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.6-2.0
10	24	2.4-2.8
25	24	3.0-3.4
10	6	1.2-1.5
25	6	1.6-1.8

Most of the landtypes have relatively low stability hazards permitting the safe installation of resource development road systems with sound planning efforts. Chief problems will accrue from bringing under management some of the lower timber producing and more-difficult-to-regenerate lands.

Subsection 11 - Devils Point Weakly Glaciated Lands Subsection

The Devils Point Weakly Glaciated Lands Subsection occupies approximately 135,000 acres in the headwaters of the Selway River. It ranges in elevation from about 4,000 to 8,000 feet. Dominant relief of the ridge and valley systems ranges from 1,500 to 2,000 feet. Most of the major ridges are broad, rounded, and relatively undissected, indicating the ridges and upper slopes at 6,000 feet and above to be in Frost Churned (cryic) Landtype associations. The headlands (generally above 7,500 feet) are weakly expressed cirques and troughs.

Bedrock in the area is dominantly granitic (probably quartz monzonite). A few outcrops of schists, gneiss and quartzite have been mapped in the northern portion of the area (probably of the Ravali group). Gneisses were also recognized in the southeast corner of the area.

Soils in the area are dominantly moderately deep to deep with loamy sands to sandy loam textures. The influence of Aeolian (windborne) materials is slight.

Habitat types are dominantly subalpine fir/beargrass, subalpine fir/whortleberry with whitebark pine/subalpine fir on high elevation knobs and rocky ridges. Douglas fir/beargrass is on lower elevation north slopes with Douglas fir/ninebark and Douglas fir/Agsp on south slopes.

Average annual precipitation ranges from 35 to 45 inches with runoff ranging from 20 to 40 inches. The following shows the range in precipitation for 6- and 24-hour storms that can be expected for selected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.8-2.1
10	24	2.6-2.8
25	24	3.0-3.4
10	6	1.5-1.6
25	6	1.6-1.8

Subsection 12 - Sabe-Magruder Moderately Glaciated Uplands Subsection

The Sabe-Magruder Moderately Glaciated Uplands Subsection is about 200,000 acres lying partially at the headwaters of the Selway River and Borgamin and Sabe Creeks draining into the main Salmon River. Elevation ranges from about 3,000 feet on the Selway River at the northern boundary of the unit to over 8,800 feet at Waugh Mountain on the southern end of the unit. Dominant relief of the ridge and valley system is generally about 2,000 feet. The main canyon north of Magruder Mountain has 3,000 feet relief. The glaciated headlands comprise about 20 percent of the area and the cirques and troughs are distinct and well formed. About 20 percent of the upper slopes and broad ridge lands show the typical smooth, undissected shapes characteristic of Frost Churned (cryic) Slopes. Most of the rest of the area is in the Moderately to Strongly Dissected Fluvial Landtype association.

Most of the subsection is underlain by quartz monzonite (some gneissic). The southwestern portion contains some Wallace equivalent schists and a few minor tertiary intrusives are mapped in other parts of the area. A major fault along Borgamin Creek extends far to the north and southwestward to the Salmon River. This fault is associated with tertiary dike swarms. Most of the drainages in the area seem controlled by structural linears.

Soils in the area are dominantly moderately deep to deep with loamy sands to sandy loam textures. The influence of Aeolian (windborne) material tends to be masked by glacial, frost churning, and colluvial action.

Habitat types are dominantly subalpine fir/beargrass, subalpine fir/whortleberry, with whitebark pine/subalpine fir on high knobs and rocky ridges. Douglas fir/beargrass is on lower elevation north slopes with Douglas fir/ninebark and Douglas fir/Agsp on south slopes.

Average annual percipitation ranges from 35 to 40 inches with runoff from 15 to 30 inches. The following shows the range in precipitation that may be expected from 6- and 24-hour storms from selected expected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.8-2.0
10	24	2.6-2.8
25	24	3.0-3.2
10	6	1.5-1.6
25	6	1.6-1.8

Subsection 13 - Red River Basin Uplands Subsection

The Red River Basin Uplands Subsection occupies about 275,000 acres of the divide country between the Crooked and Borgamin Creeks (flowing south to the Salmon River) and the Red River system which drains into the American River on the north.

Much of the geology of this subsection is similar to Subsection 19 to the north. The primary difference is that the grade of metamorphism of the bedrock in 13 is higher than in 19 and the elevation is about 800 to 1,000 feet higher. Biotite schists (mpCll) which are regarded as probable Prichard equivalents in 19 outcrop over much of 13 (Reid, 1959). Large masses of augen gneiss (m36) are present in the northeastern part of 13 and a large outcrop of quartz monzonite (Ki3c) of the Idaho Batholith is located just south of the augen gneiss complex. Bedrock is well weathered and soft (weathering classes 5 and 6).

Almost the entire area lies between 5,000 and 7,000 feet. The area is dominated (about 75 to 80 percent) by broad ridges and smooth, weakly dissected slope lands above 6,000 feet, which have many external features of lands which were subjected to frost churning (cryic) processes and are considered to be weakly cryoplanated by the Reconnaissance Survey. Only the highest elevations on northerly aspects show signs of Alpine Glaciation. These lands occupy less than 5 percent of the area. About 20 percent of the area is in the Weakly to Moderately Dissected Landtype associations.

This subsection averages about 800 to 1,000 feet higher than the Elk City Basin Uplands Subsection. This elevation difference appears to account for the much higher proportion of frost churned surfaces as compared to the Elk City Subsection.

Soils on the broad ridges and weakly dissected slopes are dominantly 2 to 3 feet thick over well weathered (grussic) bedrock. A 1 foot layer of silt loam loess cap overlies a 1 to 2 foot layer of loamy sand to sandy loam substrate. Habitat types are dominantly grand fir/clintonia, subalpine fir/whortleberry, clintonia and beargrass.

Average annual rainfall ranges from 20 to 40 inches with 20 to 30 inches runoff. The following shows the range in precipitation of 6- and 24-hour storms that can be expected for selected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.6-2.0
10	24	2.2-2.8
25	24	2.6-3.2
10	6	1.3-1.5
25	6	1.6-1.8

Subsection 14 - Buffalo Hump Glaciated Lands Subsection

The Buffalo Hump Glaciated Lands Subsection occupies about 100,000 acres of the divide country draining northward into the South Fork of the Clearwater drainage and southward into the Salmon River via the Wind River, Sheep Creek, and Lake Creek drainages.

Most of the area lies between 5,500 and 7,500 feet but ranges between 4,000 and 8,500 feet. About 80 percent of the uplands is above 7,000 feet. This portion of the area has a dominant relief of about 1,000 feet. The entire area was apparently scoured by a thick ice sheet like that which functioned 10 to 15 miles to the southwest across the Salmon River Canyon on the Granite Mountain Uplands Subsection. The typical Alpine Glaciated Landforms like cirques, troughs, etc., appear to be the result of more recent glaciation than that which gave the area its generally scoured appearance.

The present ridge systems and upper slopes have strong characteristics of past cryoplanation processes; indeed some slopes contain evidence of ongoing cryoplanation processes.

Shenon and Reed (1934) mapped the eastern part of this subsection. They differentiated between quartzites and schists in the Precambrian metamorphics but these have been lumped as Prichard Formation equivalents (mpCl1) as they are probably the same units mapped just to the east by Reid (1958). The Idaho Batholith was described as granodiorite/quartz monzonite in composition and locally these rocks graded to gneisses, as did some of the quartzites. Many andesite dikes cut the area and the major structural trend is to the northwest, but few other particulars about structures were mentioned. The development of the topography in the subsection is similar to the topographic history of the Newsome and Elk Creek Basins to the east (see Reid's 1959 discussion in Subsection 19).

Little information is available about the western portion of 14 but it is probably similar to the Burgdorf Basin Subsection to the south and the Florence Basin Subsection to the west which are almost entirely Idaho Batholith. Most of the major drainages and basins seem to coincide with north-south or northeast trending linears which are probably faults which have controlled basin drainage development.

Soils are dominantly less than 3 feet thick, but slopes with 20 to 30 percent rock outcrop are common. Thick morainal deposits commonly occupy the lower slopes of many of the drainages. Habitat types are mostly in the subalpine fir series and small wet and dry alpine meadow plant communities are common.

Average annual precipitation ranges from 25 to 40 inches with runoff from 20 to 30 inches, a rather efficient producer of water. The following

shows the range in precipitation that can be expected for 6- and 24-hour storms for selected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.6-2.0
10	24	2.4-2.8
25	24	3.0-3.2
10	6	1.3-1.6
25	6	1.6-1.8

The chief demands that future use of this area will probably be associated with are dispersed recreational use for which it has some rather unique characteristics. The eastern portion is well mineralized.

Subsection 15 - Florence Basin Subsection

The Florence Basin Subsection is 85,000 acres comprising the headwaters of Little Slate Creek (flowing north into Slate Creek) and Mill Creek (flowing north into the South Fork of the Clearwater). About 80 percent of the area lies between 5,000 and 6,000 feet; 15 to 20 percent of the area lies between 6,000 and 7,200 feet. Except for the major fault controlled drainages, the dominant relief ranges from less than 500 to 1,000 feet. The relief in the main canyons is about 2,000 feet. The median elevation is about 6,000 feet.

This area has been identified by Reid and Capps as the lower of two "old erosion" surfaces which have been discussed previously (see pages 149-153 of Geology Report). The low relief and fine meshed dendritic stream pattern together with its relatively high proportion of land in low stream orders give the area a rather low efficiency for handling sediment.

From west to east (toward Elk City) the dominant bedrock is gneissic quartz diorite (border zone), quartz diorite (near Florence), to granodiorite to quartz monzonite. Reed described schists and quartzite outcrops as the remnants of the roof which once covered the "old land" surface and which was mostly stripped off after uplift.

Good evidence of the time and magnitude of the uplift is the presence of basalts on Hungry Ridge and near Adams Ranger Station. Both these areas are above 5,000 feet. Such evidence indicates the possibility of even the lower of the two erosion surfaces having been uplifted almost 2,000 feet.

Reed (1938) noted evidence for two periods of glaciation in the area and a later stage of fluvial deposition in the main valleys. Localized ponding in these valleys has resulted in plot bags.

Alpine Glaciated Landforms are poorly expressed along the eastern boundary. Frost Churned (cryic) Landtype association prevails mostly above 6,500 feet, but this is generally rather weakly expressed. Most of the evidence of glaciation is depositional. Reed (1939) recognized a pre-Wisconsin glacial activity which provided most of the depositional materials to the basin and a Wisconsin Alpine epoch which pushed smaller glaciers down the valleys and deposited morainal down well below the level of the present basin surface. Evidence of the occurrence of pre-Wisconsin glacial activities may also exist in other sections and subsections:

Section IV	Subsection 5,6
VI	" 2
III	" 1,2,3,5,7
I	" 1,5

The bedrock in the area is characteristically grussic (probably weathering classes 5, 6 and minor amounts of 7). In the low relief Basin Lands,

soils generally have a 1-foot thick silt loam loess cap overlying 2 to 3 feet of sandy loam to loamy sand substrata reflecting the highly weathered granitic bedrock. Textures of substrata overlying schists and basalt have heavier textures (silt loams to heavy loams).

Dominant habitat types are grand fir/beargrass and grand fir/clintonia at median elevation with Douglas fir/ninebark and common snowberry at slightly lower elevations and subalpine fir/menziesia and whortleberry at the higher elevations. Whitebark pine barrens and subalpine fir/beargrass were burned in the early 1900's and still remain untimbered.

Average annual precipitation ranges from 25 to 30 inches with 10 to 20 inches runoff. The following shows the range in precipitation that can be expected for 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.6-2.0
10	24	2.0-2.4
25	24	2.6-3.2
10	6	1.3-1.6
25	6	1.6-1.8

Subsection 16 - John Day Subsection

The John Day Subsection is a small (approximately 40,000-acres) area occupying a steep, well dissected ridge just northeast from the Little and Main Salmon at Riggins. It is bounded on the north by Slate Creek, on the west and south by the Salmon River Canyonlands, and on the east by Florence Basin. It ranges in elevation from 3,000 feet at Slate Creek to about 7,600 feet at southwest Beetle. Dominant relief is almost 3,000 feet. Median elevation is about 5,800 feet.

The geology of the area is over 80 percent underlain by a border zone granitic. The northeastern part of the area is covered by Martin Bridge limestone and the southwestern part by a gneiss complex. The area is bounded on the southwest by Fiddle Creek schist. The latter three formations are associated with the Permian-Triassics of the Seven Devils. The eastern boundary parallels a long north-south fault which separates the Florence Basin Subsection to the east.

Most of the area is in the Moderately to Strongly Dissected Fluvial Landtype association. The broad main ridge and smooth, weakly dissected upper slopes above 6,500 feet are in the Frost Churned (cryic) Landtype associations. Soils here are moderately deep to deep with moderately thick to thick loess caps overlying stony, moderately coarse textured subsoils. Bedrock ranges from hard to soft (weathering classes 3-6). Soils on the Fluvial Lands are dominantly moderately shallow to moderately deep, moderately stony with moderately coarse textures. Lands in this area have moderately high potential for sedimentation.

At the lowest elevations in this subsection, bluebunch wheatgrass/sandberg bluegrass and bluebunch wheatgrass/Idaho fescue are the predominant nontimbered types. Ponderosa pine/Idaho fescue occurs on the warmest driest sites on the lower edge of the timbered zone. The bulk of the Douglas fir zone at midelevations is dominanted by Douglas fir/common snowberry and Douglas fir/ninebark. On moist protected sites grand fir/queencup is present. At the higher elevations some subalpine fir/beargrass and subalpine fir/grouse whortleberry may be found.

Average annual precipitation ranges from about 20 to 35 inches and runoff from about 10 to 20 inches. The following shows the range in precipitation that can be expected for 6- and 24-hour storms for selected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.4-1.8	2.0
10	24	2.0-2.4	
25	24	2.6-3.0	
10	6	1.3-1.4	
25	6	1.5-1.6	

Subsection 17 - Dairy Mountain Dissected Plateau Land Subsection

The Dairy Mountain Dissected Plateau Land Subsection occupies an area about 12 miles wide from Slate Creek to the foothills south of Grangeville on the east and Harper on the west, about 130,000 acres. The area lies mainly between 4,000 and 6,000 feet and is deeply incised (up to 1,000 feet) by Whitebird, Skookumchuck, McKenzie, and Slate Creeks flowing west into the Salmon River.

The area is a tilted Columbia River basalt plateau. The plateau itself is westward tilting at about a 6 percent slope gradient to the west and is related geologically to the basalts of the Columbia Intermontane Province. Two flows have been recognized in the area with the "lower" flow only exposed in the stream entrenched canyons. Soils from the upper flows appear to be thicker, less stony and have higher moisture holding capacities than do the soils in the canyons derived from the lower formation. On southerly slopes soils on the upper formation dominantly have moderately shallow, strong soils with heavy loam surfaces and clay loam subsoils and support both nontimbered and timbered habitats. Nontimbered habitats are mainly bluebunch wheatgrass/sandberg bluegrass and bluebunch wheatgrass/Idaho fescue.

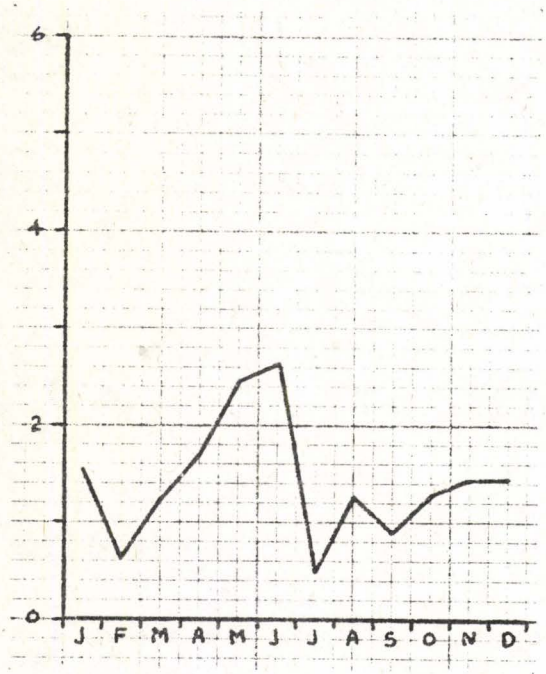
Timber habitat types on south slopes are mainly the ponderosa pine/bunch grasses. North slope soils are mainly deep colluvial loams to clay loams and support mainly the Douglas fir/ninebark habitat type. Some soils on both north and south slopes have their loess surfaces. The steep entrenched "breaks" slopes of the canyons occupy over 50 percent of the area.

Average annual precipitation ranges from about 12 to 25 inches and runoff from 5 to 10 inches. Figure 1 shows the range in precipitation that can be expected for 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.4-1.6
10	24	2.0-2.4
25	24	2.4-3.0
10	6	1.3-1.4
25	6	1.5-1.6

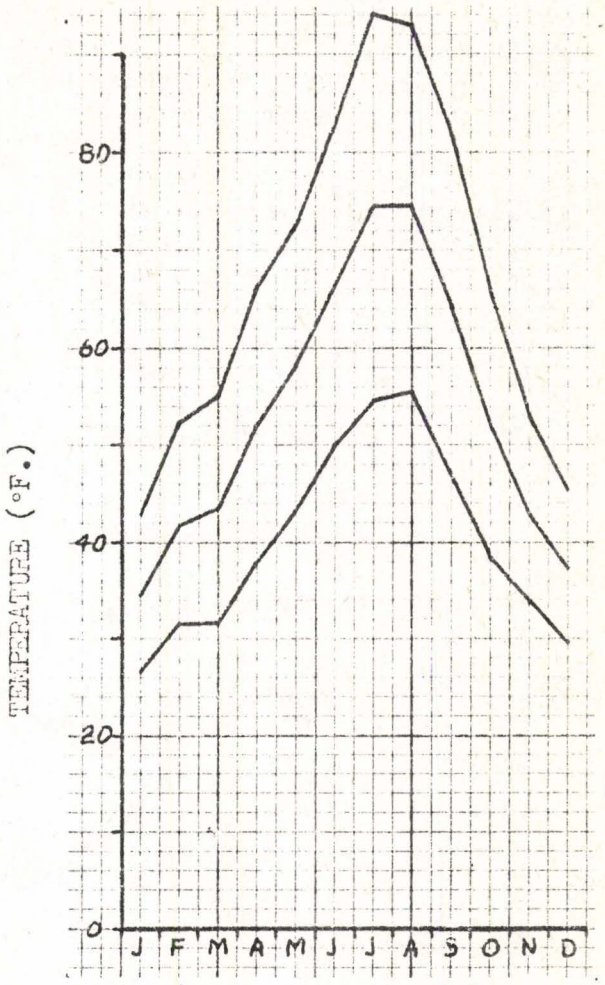
Figures 2 and 3 show the distribution of rainfall and the average maximum, minimum, and mean temperatures for nearby Slate Creek Ranger Station to give some idea of the warm, dry climate characteristic of the lower elevation and south slopes in this subsection.

Figure 2



SLATE CREEK R.S.
ELEV. = 1568
YEARS = 5*
A.A.P. = 16.98

Figure 3



SLATE CREEK R.S.
ELEV. = 1568
YEARS = 6*
67.1-53.6-40.0

Subsection 18 - Lower South Fork Clearwater Strongly Dissected Lands Subsection

The Lower South Fork Clearwater Strongly Dissected Lands Subsection is roughly 12 by 20 miles (about 240 square miles) and lies east of Castle Creek Ranger Station. It is roughly bisected by the Clearwater River. Elevations range from about 2,500 feet at the western boundary on the river to almost 7,000 feet on the highest ridges. Median elevation is about 4,500 to 5,000 feet. Dominant local relief ranges from 1,500 to 2,000 feet. It is drained by north and south flowing streams flowing into the river. The main drainages are Johns Creek, Twenty Mile Creek, Meadow Creek and Silver Creek.

This area is actually a well-dissected portion of the "old land surface" mentioned previously in the descriptions of nearby Subsections 13, 14, 15, and 19. Only on the broad, gently sloping interfluves (ridges between drainage dissection) is the "old surface" relatively preserved.

It appears to be an upland counterpart of the "lower" old surface. The basin counterparts of the "lower" old surface are in the Florence and Elk City Basin and Uplands Subsection. This area so far has produced no evidence of pre-Wisconsin glaciation or eocene (tertiary) deposition as has been observed in adjacent areas (and elsewhere). This may be due to the "upland" rather than "basin" character of this subsection which would subject the area to being stripped of previously deposited materials.

Major rock types in the area consist of the Belt metasediments (mainly biotite gneisses, schists and quartzites) and Idaho Batholith rock (mainly granodiorite ranging to quartz monzonite). Kuhns (1974) described an extensive unit of batholith and partially melted metasediments which in total has essentially a granitic character. This last unit is deeply weathered, especially in the gently rolling uplands.

Soils on the protected uplands have a moderately thick loess cap of silt loam textures. Substrata textures range from loamy sands to silt loams depending upon parent materials: loamy sandy to sandy loams from granitics, quartzites and some grusses; fine sandy loams to silt loams from schists. Soils tend to be very thick on the protected uplands and moderately thick to thin on the upper portions of the entrenched slopes.

The broad uplands above 6,000 feet show frost churned (cryic) characteristics with variable coarse fragment contents. Soils on the entrenched slopes are more variable but in general are not as deep as soils on the uplands. Depth, texture, and stoniness vary markedly on the entrenched slopes with position slope, bedrock, and slope and steepness of slope. Glaciation is only weakly expressed at the highest elevations in the area. Habitat types in these areas are dominantly subalpine fir/whortleberry. From this area to slightly above 6,000 feet subalpine fir/clintonia is dominant, with Douglas fir habitat types on the drainage entrenchments.

Average annual precipitation ranges from 25 to 35 inches with runoff from 10 to 20 inches. The following shows the range in precipitation that can be expected from 6- and 24-hour storms for selected return frequencies.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.6-2.0	
10	24	2.4-2.8	
25	24	2.8-3.0	3.2
10	6	1.3-1.5	1.6
25	6	1.5-1.6	

Lands typical of Elk City Subsection (III-19).

Subsection 19 - Elk City Basin and Uplands Subsection

The Elk City Basin and Uplands Subsection occupies about 235,000 acres drained mainly by headwaters of the South Fork of the Clearwater River. Elevations range from about 3,500 feet at the western border in the canyon to about 7,000 feet at Dent Point, Sable Hill and Pilot Knob. About 85 percent of the area is between 4,000 and 6,000 feet. Average elevation is about 800 to 1,000 feet lower than the Red River Basin Uplands Subsection (13) to the south. Local relief in the tributaries is dominantly from 1,000 to 1,500 feet. The area represents a portion of the "old erosion" surface mentioned previously (Subsections 2, 3, 13, 14, 15, 18). The area has strong basin characteristics and has tertiary gravel deposits over the widest area of any of the old land surface areas. Possible correlatable gravels have been observed by Reed (1934) in Big Creek, the head of American Creek, Adams Ranger Station, Whitebird Station, Peasley Creek, Silver Creek divide, Meadow Creek, the head of Johns Creek and Blacktail Butte near Florence. Capps (1939) found identical rocks in gravels in the Secesh and Warren mining districts.

The area appears to have been relatively unaffected by even pre-Wisconsin ice-sheet type glaciation. The Florence Basin Subsection, 20 miles to the west, has evidence of pre-Wisconsin glaciation (see pages 160-162 of Geology Report for discussion of structure history).

The bedrock in the Elk City area was described by Reid who recognized four major units: (1) Quartzite which may be biotite quartzite, muscovite quartzite (relatively rare), pure white quartzite, or feldspathic-biotite quartzite which grades to biotite gneiss; (2) biotite gneiss which is the most abundant rock in the area; (3) augen gneiss which is in the southeastern part of the subsection; and (4) granitic rocks which, mixed with metamorphic rocks, makes up more than half the total rock volume. The biotite schists and quartzites are now tentatively assumed to be equivalent to the Prichard Formation (mpCll) and are so designated on the Elk City AMS map (Reid, Greenwood, and Morrison, 1973).

The bedrock is dominantly well weathered (weathering classes 4-6). Soils on the rolling uplands are dominantly deep with about a 1-foot silt loam loess cap overlying a 2-3 foot loamy sand to sandy loam substrata over well weathered bedrock. Soils on the tertiary gravely terraces are extremely thick and have medium to moderately fine textured subsoils. Soils on the Steeper Fluvial Landtype associations have thinner to absent loess caps and are generally more shallow; bedrock is apt to be more competent (less weathered).

Frost churned (cryic) surfaces occupy the broad ridges and upper slopes at the higher elevations but probably occupy less than 20 percent of the

area. The effects of alpine glaciation are, at best, only weakly expressed on the highest knobs in the area. Lake deposits are common in some of the lower elevational meadows.

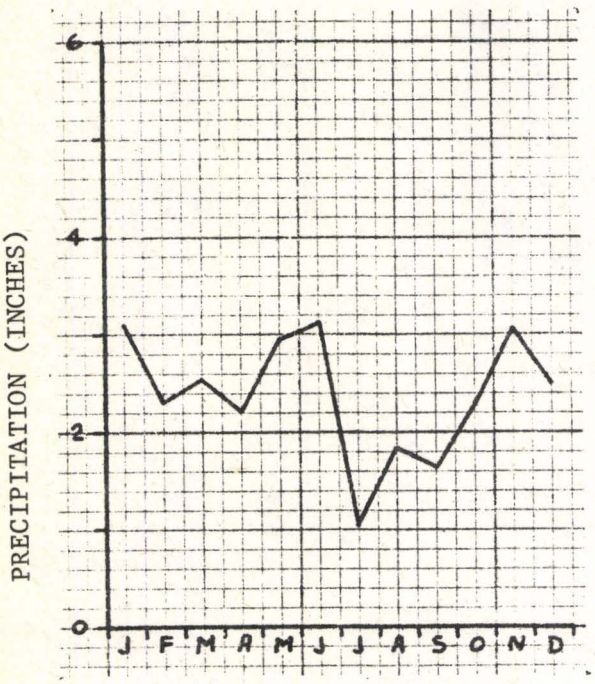
Forest habitat types are mainly in the grand fir and subalpine fir series, but Douglas fir is found on some of the warmer slopes in some of the lower elevational canyons.

Average annual precipitation ranges from 30 to 45 inches and runoff from 15 to 25 inches. Figure 1 shows the range that can be expected for 6- and 24-hour storms that can be expected from selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.6-2.0
10	24	2.4-2.8
25	24	2.8-3.2
10	6	1.3-1.6
25	6	1.5-1.8

Figures 2 and 3 show the distribution of rainfall and the average maximum, minimum and mean temperatures.

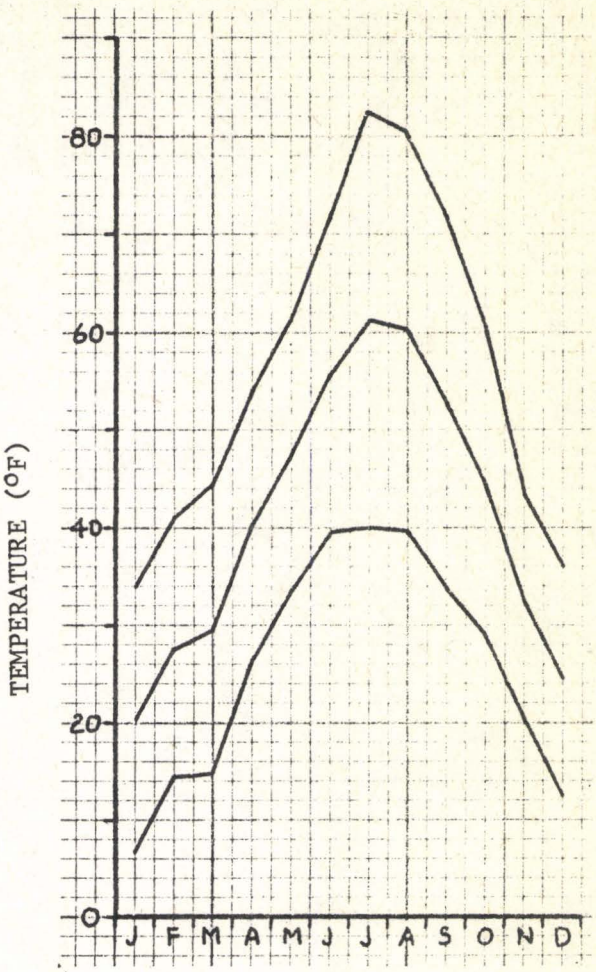
Figure 2



MONTHS

ELK CITY
ELEV. = 3975
YEARS = 10*
A.A.P. = 28.61

Figure 3



MONTHS

ELK CITY
ELEV. = 3975
YEARS = 10*
56.8-41.4-25.9

The area has high timber, mineral, and big game values. Possible conflicts are readily apparent, especially with sedimentation from mining and road building activities.

Subsection 20 - Selway Moderately Dissected Lands Subsection

The Selway Moderately Dissected Lands Subsection occupies about 12,000 acres south of the Lochsa Selway Canyon Lands near the confluence of the two rivers and north of the Elk City Basin and Uplands Subsection.

The area appears to be a highly dissected portion of the "old erosion surface" mentioned in the descriptions of most of the subsections in the Salmon Uplands Section. The drainages in the area have entrenched themselves into the area to the extent that reliefs of 2,000 to 2,500 feet are in Falls and O'Hara Creeks. Dominant relief of the broad ridge systems between drainage entrenchments is about 1,000 feet. About 85 percent of the area lies between 4,000 and 5,500 feet. This indicates that most of the area lies mostly below the zone of Frost Churned (cryic) Landtype associations and all of it below alpine glacial activities. Most of the area lies in the Fluvial Landtype associations.

Anderson (1956) described the rock types in the subsection as gneisses and schists during a very general reconnaissance of the region. Greenwood and Morrison (1973) show that the Belt metamorphic equivalents mpC11 (Prichard Formation), mpC12 (Ravelli group), and mpC13 (Wallace Formation) continue through this subsection from the Middle Fork of the Clearwater. Granitics are common intrusives. Bedrock is characteristically well weathered, especially in the uplands. Greater rock competence is generally found in the canyons.

Soils in the uplands consist dominantly of about a 1-foot silt loam loess/loess cap over (colluvial) loamy sand to sandy loam substrata overlying moderately to highly weathered granitic or border zone bedrock.

Habitat types are dominantly cedar/pachistima, grand fir/clintonia, subalpine fir/clintonia, Douglas fir/ninebark with cedar/lady fern in the lowlands.

Average annual precipitation ranges from about 35 to 45 inches and runoff from 10 to 20 inches. The following shows the range in precipitation that can be expected for 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.6-2.0
10	24	2.2-2.8
25	24	2.8-3.2
10	6	1.4-1.6
25	6	1.6-1.8

Key to the management of the area lies in the development of the roadnet in and out of the area. It can be done most safely coming in from above and avoiding the location and construction of roads across the steep canyon slopes which have high mass failure potentials.

Subsection 21 - Copper Butte Dissected Glaciated Land Subsection

The Copper Butte Subsection occupies about 190,000 acres south and adjacent to the Selway Canyon between Meadow Creek and the confluence of Moose Creek and the Selway River.

Elevations range from about 3,000 feet to 7,600 feet. However, almost 75 percent of the area lies between 5,000 and 7,000 feet. Relief in the major drainages ranges from 2,000 to 3,000 feet and about 1,000 to 1,500 feet on the ridges above the entrenched drainageways. The heads of the main drainages like Buck Lake Creek, Martin Creek, the Forks of Meadow Creek, Ditch Creek, and Running Creek have weakly to moderately expressed alpine glaciated features. The smooth, broad ridges and upper slopes between about 6,000 and 7,000 feet are in the Frost Churned (cryic) Landtype associations (about 60 percent of the area). The rest of the area is in the Moderately to Strongly Dissected Fluvial Landtype associations.

According to Greenwood and Morrison (1973), rock units within the area are biotite quartzite, schists, and gneisses which they tentatively assigned to the Ravelli group (mpC12). A band of Wallace equivalent metamorphic rocks, mainly quartz-biotite-plagioclase gneisses and schists, and biotite-plagioclase quartzites, extends northwest to southeast through the central portion of this unit. The central area of 21 is composed of quartz monzonite of the Batholith while the northeastern third is a Tertiary pluton (Tei3). The Tertiary pluton is similar in description to the Sawtooth Batholith (Section I, Subsection 12).

Major linears show the standard pattern of north-south trending faults which control drainages and valley development. The western contact of the Tertiary intrusive may also be fault controlled as it lies on a north-south linear.

Bedrock weathering is variable but is probably more weathered in the western portion and in the broad uplands. The Tertiary granitic pluton is relatively fresh and only slightly weathered. Quartzites also should be relatively fresh.

Habitat types are mainly in the subalpine fir and grand fir series with Douglas fir series at lower elevations. Although little soil investigation has been done in the area, the following are the likely dominant soil characteristics in the area:

1. In the Strongly Glaciated Lands: moderately deep to shallow with dominantly sandy loam textures.
2. In the Frost Churned (cryic) Ridges and Upper Slopes: thin silt loam loess caps over 1 to 2 feet. Sandy loams to loamy sand over moderately well weathered bedrock.

3. In the Steep Fluvial Lands: thin to mixed loess cap surfaces of 1-2 feet. Stony sand loams of slightly to moderately weathered bedrock.

Average annual precipitation ranges from 40 to 50 inches with 20 to 30 inches runoff. The following shows the range in precipitation that can be expected for 6- and 24-hour storms for selected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	2.0-2.2	1.8
10	24	2.8-3.0	
25	24	3.2-3.6	
10	6	1.5-1.7	
25	6	1.8-1.9	

Subsection 22 - Running Creek Streamcut Lands Subsection

The Running Creek Streamcut Lands Subsection occupies about 100,000 acres in the Selway-Running Creek Canyon above Moose Creek Ranger Station. Elevations range from less than 3,000 to about 6,000 feet with about half the area between 4,000 and 5,000 feet. This canyon is entrenched mainly in the Major Borgamin fault which extends south to the Main Salmon River and north to the head of Moose Creek.

Small outcrops of Wallace equivalent metasediments (mpC13) occur throughout the area but most of 22 is underlain by quartz monzonite (Ki3C) of the Batholith or the northeastern part of Tertiary pluton (Tei3); the former being moderately weathered and the latter only slightly weathered.

The area is sparsely vegetated, mainly with mountain brush and grass communities. The lack of timber cover is probably due to a hard burn (1910 burn?). It has been suggested the habitat type is Douglas fir and grand fir/beargrass with grand fir/clintonia in the draws.

The area appears extremely droughty with many areas having extremely sparse ground cover.

Soils are probably dominantly shallow to moderately deep with mostly loamy sand textures.

Average annual rainfall is 35 to 45 inches with 10 to 20 inches runoff. The following shows the range in precipitation that can be expected from 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.8-2.2
10	24	2.6-2.8
25	24	3.2-3.4
10	6	1.5-1.8
25	6	1.8

Section IV - Lochsa Uplands Section

The Lochsa Uplands Section is a 2,900 square mile area. It contains the entire Lochsa drainage, the Lower Selway Canyon and the lower portion of the Clearwater. The area ranges from less than 2,500 feet to over 8,000 feet in elevation. Excluding the Selway-Lochsa Canyon, the median elevation is about 4,500 to 5,000 feet. Relief varies considerably in the six subsections that have been identified.

	Dominant Relief
1. Selway-Lochsa Canyonlands Subsection	3,000'
2. Clearwater Uplands (old erosion surface) Subsection	1,500'
3. Craigs Alpine Glaciated Lands Subsection	2,000'
4. Moose Creek Headlands Subsection	3,500'
5. Bitterroot Glacially Modified Subsection	1,500' Uplands 2,500' Canyons
6. Lolo Rolling Uplands Subsection	2,000'

Structurally this section is related in part to the "old land surfaces" which dominate the Salmon Uplands Section. This is mainly expressed in the Clearwater Uplands Subsection and the Craigs Alpine Glaciated Lands Subsection. The eastern portion shows a structural affinity with the Bitterroot Mountain activities and to some extent to the Lewis and Clark thrust zone to the north.

The eastern two-thirds of this section are almost entirely underlain by rocks of the Idaho Batholith. The western one-third is occupied by a complex mixture of granitics and Precambrian metasediments and even some of the eastern outlines of the Columbia River basalts on the northwest.

This section has a markedly different climate than the sections to the south. It does not have any significant mountain barriers to impede the normal movement of moisture-laden air masses from the Pacific Ocean. Most of the total annual precipitation is from frequent cyclonic storms traveling on an easterly course.

Average annual precipitation is 48.24 area-inches. Annual precipitation ranges from 25 inches in the lower portions of the Middle Fork of the Clearwater River to over 60 inches in the highest portions of the section.

The majority of precipitation received on the section occurs from November through March. This period, which corresponds to the frequent moisture-laden cyclonic storms from the Pacific Ocean, accounts for nearly 60 percent of the total annual precipitation. Cyclonic activity from the west also accounts for intermittent precipitation during the other seven months. High moisture-laden air masses from the Gulf of Mexico contribute significant precipitation during May and June. Less than 5 percent of the total annual precipitation occurs in July and August, the driest months.

April 1 and May 1 snow course surveys show highest snowpack water content. Water content during April 1 snowpack surveys appears to be approximately 50 percent of the annual precipitation.

The average annual maximum, mean, and minimum air temperatures for this section at median elevation are 53.1°F., 40.0°F., and 25.7°F., respectively. The average annual maximum-minimum variation is 27.4°F. The main reason for the relatively warm maximum, mean, and minimum temperatures is the relatively low median elevation. The low maximum-minimum variation is due mainly to the maritime influence of the Pacific Ocean. The range in elevation within the section is 6,800 feet. This can account for nearly 24°F. temperature difference between the lowest and highest areas of the section at any one time.

Growing season data are sparse for this section. Fenn R. S. (elevation: 1,580 feet) and Pierce R. S. (elevation: 3,175 feet) have expected growing seasons of 159 and 68 days respectively. Growing seasons approach zero days within the eastern high elevation topography.

The section annually yields an average 26.49 area-inches (4,097,000 acre-feet) of water. Average annual runoff ranges from 1 to 53 inches. This section is an efficient water producer, yielding more than 54 percent of the total annual precipitation.

The Clearwater Uplands Subsection utilizes an average of 21.75 area-inches (3,364,000 acre-feet) of water annually for evapotranspiration.

The climatic regime of this subsection begins to impose its strong influence on the distribution of habitat types. The commonly occurring western red cedar and hemlock series in this section are good indicators of this change. These series do not generally occur in Section III.

Another strongly expressed feature in this section is the common occurrence of aeolian deposits (windborne materials) 1- to 2-feet thick. The mix of these environmental factors results in some of the most productive timber land in the state, especially in the northern portion of the section.

Selway-Lochsa Canyonlands Subsection (IV-1) with Craigs Alpine Glaciated Lands Subsection (IV-3) in background.

Selway-Lochsa Canyonlands Subsection (IV-1) with
Clearwater Uplands Subsection (IV-2) in background.
In the vicinity of Tomcat and Wildhorse Creeks.

Subsection 1 - Selway-Lochsa Canyonlands Subsection

The Selway-Lochsa Canyonlands Subsection is about 375,000 acres in extent. It contains almost the entire length of the Lochsa River and the lower half of the Selway River. Elevations on the Lochsa River range from 1,400 feet to about 5,000 feet. Elevations on the Selway River range from about 1,600 feet to 2,500 feet. Relief in the canyon ranges from 2,000 to 4,000 feet. The canyon is well dissected with perennial drainages spaced at less than 3/4 mile.

Bennett (1974) summarized the geology in the area as follows:

> Much of the western part of this section is covered by a series of Precambrian Belt metasediments including rocks equivalent to the Prichard Formation (mpC11), the Ravalli Group (mpC12) and the Wallace Formation (mpC13). The Prichard Formation is composed of quartzites and schists; the Ravalli Group, quartzites, various schists, and some calc silicates; and the Wallace Formation, schists and gneisses with frequent calc silicate units (Wallace is the most calcareous of the Belt Super Group). These rocks are aligned in a northwesterly trend which changes to a curvilinear pattern in Subsection 2. An interesting feature of the subsection is that in the offset in the Lochsa River are several outcrops of the Idaho Batholith (coarse quartz monzonite, (Ki3c), while southeast along the Selway the border of Subsection 1 intersects a Tertiary granitic intrusion.

Habitat types in the area are widely divergent Douglas fir, grand fir, cedar and subalpine fir series which are all well represented. Topography and character of parent material and bedrock are the chief controlling features to the stability of slopes in the area. Micaceous schists and gneisses provide materials which provide for severe mass stability problems, making it difficult to construct stable roads across slopes in the area. Some quartzites, however, offer stability features which permit possible successful road locations.

Lower elevational and relief portion of Clearwater Uplands Subsection (IV-2). Drainage is North Fork Clearwater.

Clearwater Uplands Subsection in Lochsa Uplands Section (IV-2). Note smooth, frost churned surface remnants on main ridge systems.

Subsection 2 - Clearwater Uplands Subsection

The Clearwater Uplands Subsection occupies about one-half million acres of the western portion of the Lochsa Section, roughly between 46°10' and 46°55' north latitude.

This area appears to be a part of the "old eroison surface" which has been uplifted and rejuventaed to varying degrees within the area. Total elevation ranges from less than 2,000 feet on the North Fork of the Clearwater to about 6,500 feet in the Windy Ridge area. From west to east there appears to be concordant levels at about 4,000, 5,000 and 6,000 feet levels. Relief of the uplands ranges from less than 500 feet to about 1,000 feet. Maximum relief from the bottom of a major entrenched tributary to the main ridge system seldom exceeds 2,000 feet. All these surfaces characteristically have well developed, dendritic drainage patterns, deep soils, highly weathered bedrock, and a thick loess cap. The highest levels show weakly expressed frost churned (cryic) characteristics. Fifteen to twenty percent of the area is Weakly to Strongly Rejuvenated Slopes adjacent to main tributaries which are entrenching into the old surface.

Bedrock is dominantly granitic of the Idaho Batholith, gneisses, schists and quartzites of the Precambrain Belt Super Group. Small islands of basalt are included on the uplands between Orofino Creek and the North Fork of the Clearwater River. Also, rather extensive areas of anorthosite are found in the northernmost part of the subsection.

Soils from the metamorphics in the uplands are 6 to 10 feet deep with an 18- to 36-inch silt loam loess cap. Weakly developed textural B horizons can be found in places. Soils characteristically have a few coarse fragments (generally weathered quartzites). Soils from weathered schists and some gneisses occur in places and provide special problems to road building and slope failure.

Soils developed over granitic bedrock are 5 to 10 feet thick with 18- to 36-inch loess caps. Subsoils are loamy sands with a conspicuous lack of coarse fragments. Bedrock is dominantly in weathering classes 5 and 6.

Hydrologic response in the uplands is noteably slow. The area drained by first order streams in the area is relatively small.

Draws in the uplands are filled with thick deposits which have been in place for long periods. Fourth order streams meander through thick valley fill, dominantly sandy alluvial valley fill.

Chief habitat types are as follows:

cedar/devils club
cedar/maidenhair and lady fern
w. hemlock/clintonia
subalpine fir/clintonia

The chief landtype associations are as follows:

Weakly Frost Churned (cryic)	- 15%
Moderately to Strongly Dissected Fluvial Lands	- 15%
Canyon Lands	- 10%
Moderately Dissected Uplands (old erosion surface)	- 60%

The margins of the old erosion surfaces are quite hazardous for mass failure. As the rejuvenation from the tributaries of the main streams becomes entrenched into the old surface, the thick mantles, having a high moisture-holding capacity, tend to have high impacts as mass failures occur. These are breaks on which, in the past, the Clearwater has located much of its road system. It has and will limit what can be done in the other areas because the streams or watersheds are now loaded with sediment because of past failures and erosion. In the Pete King drainage some 23 percent of the total mileage of the road was contributing above 90 percent of the total sediment into the drainage. The sediment is coming from this narrow zone of rejuvenation as the rejuvenation has fallen back into the old land surface.

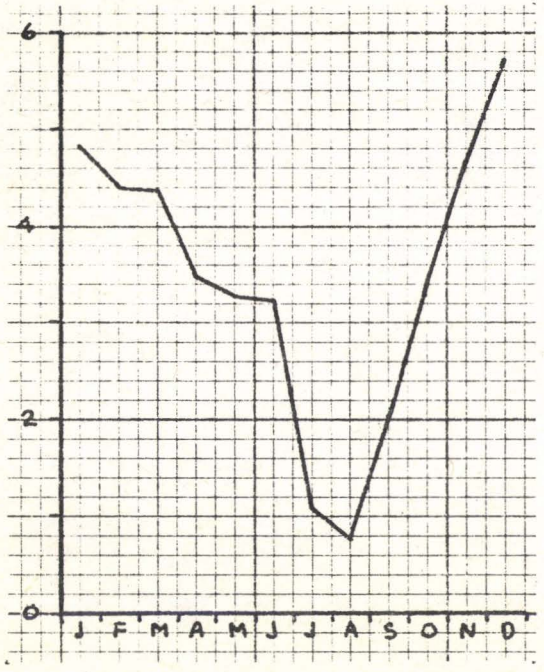
Average annual precipitation ranges from 40 to 60 inches and runoff from 10 to 50 inches.

Figure 1 shows the range in precipitation that can be expected from 6- and 24-hour storms for selected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	2.0-2.2
10	24	2.6-3.0
25	24	3.0-3.4
10	6	1.4-1.7
25	6	1.8-2.0

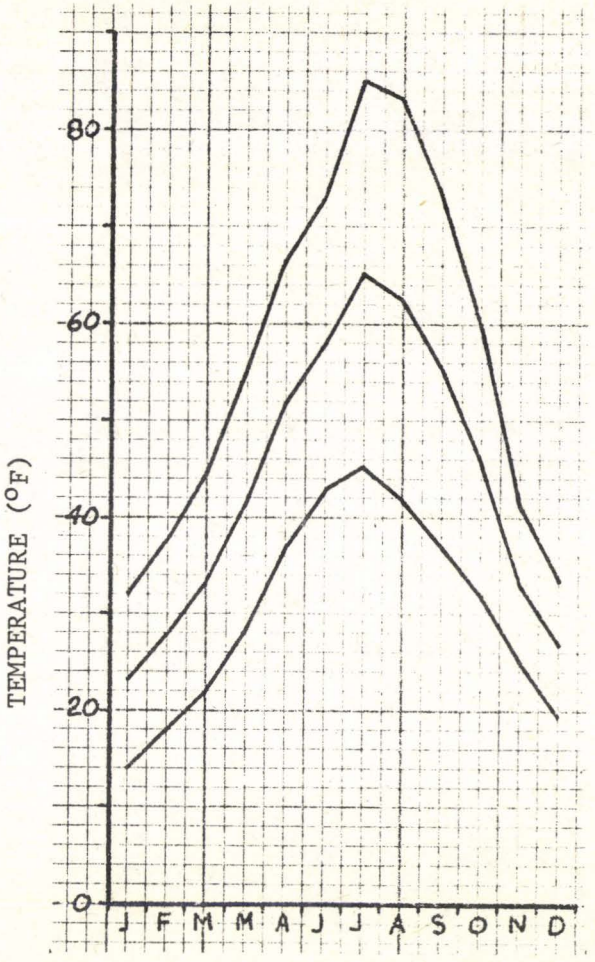
Figures 2, 3, and 4 show the distribution of precipitation, the average maximum, mean, and minimum temperatures and the water content of the snowpack, respectively, at Pierce Ranger Station.

Figure 1



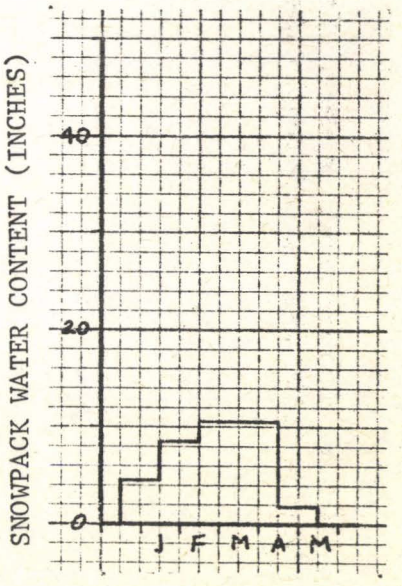
PIERCE R.S.
ELEV. = 3175
YEARS = 30
A.A.P. = 41.34

Figure 2



PIERCE R.S.
ELEV. = 3175
YEARS = 25
57.1-43.6-30.2

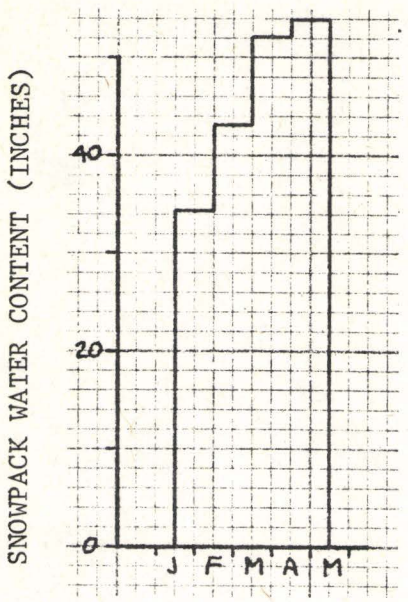
Figure 3



PIERCE R.S.
ELEV. = 3170

Figure 5 shows the average water content of the snowpack at Hemlock Butte, elevation 5,500 feet (2,325 feet higher than at Pierce).

Figure 5



HEMLOCK BUTTE
ELEV. = 5500

Much of the area has high to moderately high productive potentials for timber. Materials exposed by road construction are highly erodible and as stated, roads constructed on the "breaks" between the upland surface and the rejuvenated slopes of the main tributaries are subject to mass failure, both in the fills and cut slopes. This is particularly true in concave, basinlike areas of moisture concentration. Within the upland surface, sediment delivery efficiencies tend to be low and as long as water from roads is not channeled, the sediment from roads may be effectively buffered. The soils are generally well suited to stabilization with vegetation. Also, the relatively low relief permits construction of less steep back slopes.

Subsection 3 - Craigs Alpine Glaciated Lands Subsection

The Craigs Alpine Glaciated Lands Subsection is about 140,000 acres of high upland above the confluence of the Lochsa and Selway Rivers. It drains north into the Lochsa and south into the Selway. This area represents an example of the higher elevational "old surface" discussed previously. About two-thirds of the area is above 6,000 feet elevation and about one-half is between 6,000 and just under 8,000 feet. Indications are that this "surface" may have been uplifted as much as 4,000 feet from its original level. Dominant relief is about 2,000 feet, but the central core of the area contains numerous broad Alpine Glaciated Cirque Headlands with less than 1,000 feet relief. The headlands contain numerous (more than 40) lakes.

The area appears to have been glaciated by an extremely thick ice sheet like that which glaciated the Granite Mountain Subsection 60 miles to the southwest across the Salmon River Canyon in the Salmon Uplands Section. The dominantly quartz monzonite bedrock has been heavily scoured leaving much exposed bedrock. Also, many of the trough side slopes and basins are thin soiled. The bedrock appears dominantly in weathering classes 2 and 4.

The soils are dominantly loamy sands high in coarse fragments. Many of the slopes show evidence of present-day frost churning (cryic) processes, with much patterned ground including felsenmeers.

Timber habitat types are dominantly in the subalpine fir series with subalpine fir/whitebark pine community common at the higher elevations, meadows and high elevation brush communities are presently common.

The area is a high water producing area with extremely high alpine scenic qualities.

Average annual precipitation ranges from about 45 to 60 inches and runoff from 20 to 40 inches. The following 1 shows the range in precipitation that may be expected from 6- and 24-hour storms for selected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	2.0-2.5	
10	24	3.0-3.4	
25	24	3.6-4.0	
10	6	1.5-1.8	1.9
25	6	2.0-2.2	

Snow course records at Coolwater Mountain (elevation 6,200 feet) show the average water content of the snowpack from March 15 to May 15 to be about 30 inches.

Subsection 4 - Moose Creek Headlands Subsection

The Moose Creek Headlands Subsection occupies the steep, strongly dissected rejuvenated slopes of the lower portion of the Moose Creek drainage east and north of the Moose Creek Ranger Station. Elevations range from about 2,500 feet in the long (9 miles), broad (1 mile) valley of Moose Creek to a 7,000-foot ridge system. Dominant relief is about 3,000 feet. Drainageways appear structurally controlled by a couple of offsets, one of which coincides with a younger (Tertiary) granitic pluton in an otherwise quartz monzonite bedrock of the Idaho Batholith.

The major landtype associations are as follows:

Strongly Dissected Fluvial Lands	80%
Steep Frost Churned (cryic) Lands	15%
Alpine Glaciated Lands	5%

Dominant habitat types are in the subalpine fir, grand fir, and Douglas fir series.

- Subalpine fir/beargrass
- Subalpine fir/woodrush
- Subalpine fir/dwarf huckleberry
- Subalpine fir/menziesia (intermediate elevation)
- Grand fir/beargrass
- Grand fir/clintonia (bottom)
- Douglas fir/beargrass
- Douglas fir/ninebark

Soils are dominantly shallow to moderately deep loamy sands with well fractured bedrock in weathering classes 3-4 (quartz monzonite) and 2-3 (Tertiary pluton).

Average annual precipitation ranges from 40 to 50 inches with 10 to 30 inches runoff. The following shows the range in precipitation that may be expected for 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	2.0-2.4
10	24	2.8-3.2
25	24	3.4-4.0
10	6	1.5-1.8
25	6	1.8-2.2

The extreme steepness of slopes constitutes an extreme hazard to management of lands in this subsection.

Subsection 5 - Bitterroot Glacially Modified Subsection

The Bitterroot Glacially Modified Subsection is an area of about 310,000 acres bounded on the east by the Bitterroot Front Section, on the north by the Lochsa River, and on the south and west by the Moose Creek Headlands and Craigs Alpine Glaciated Lands Subsections. It ranges in elevation from about 4,000 feet on Moose Creek to over 8,000 feet at Grave Peak. About 30 percent of the area lies above 6,000 feet.

The area lies between the glacial scoured lands of the Craig Mountain area on the west and the strongly expressed alpine glaciation of the Bitterroots on the east. The uplands above 6,000 feet have a dominant relief of 1,000 to 1,500 feet and have the appearance of having been modified by a thick ice sheet. This modification took place prior to the alpine glaciation which gouged the glacial trough of the major drainages (like Moose Creek and the White Sand Creek).

Glacial trough lands occupy about 15 percent of the subsection. Evidence of earlier extremely thick glacial tills are found on the lower slopes of White Sand Creek. These tend to be thick, coarse textured, with large amounts of coarse fragments. In some places the till is dense and hard (resembling concrete). Till like this less than 4 feet from the surface is sensitive to erosion when vegetation is removed. More recent tills are on the trough slopes. A thick to thin loess cap is found throughout the area. At higher elevations, above 7,000 feet, Frost Churned (cryic) Landtypes are common and loess caps in these areas tend to be thin or mixed with the sandy granitic soil materials. Loess mixing on the steep trough slopes is common also.

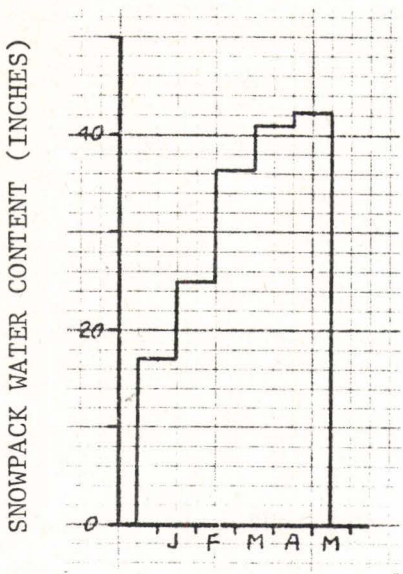
Habitat types are chiefly in the subalpine fir, mountain hemlock, grand fir and Douglas fir series.

Average annual precipitation ranges from about 45 to 60 inches and runoff from 20 to 40 inches. Figure 1 shows the range in precipitation that may be expected from 6- and 24-hour storms for selected return intervals.

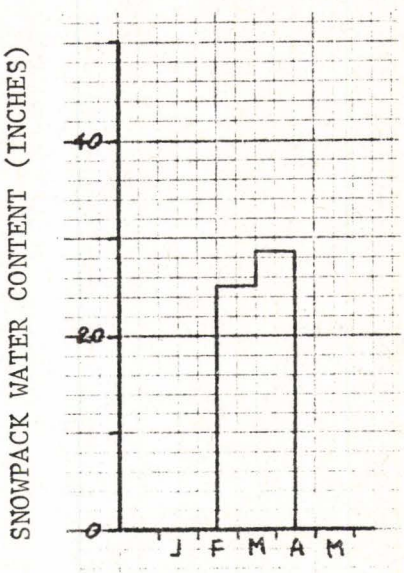
Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	2.4-2.5	2.2
10	24	3.2-3.4	
25	24	3.8-4.0	3.6
10	6	1.8-1.9	1.6
25	6	1.8-2.2	

Figure 2 shows the water content of the snowpack for Fish Lake and Savage Pass. The data infers a rain shadow effect.

Figure 2



FISH LAKE AIRSTRIP
ELEV. = 5000



SAVAGE PASS
ELEV. = 6160

Subsection 6 - Lolo Rolling Uplands Subsection

The Lolo Rolling Uplands Subsection is about 120,000 acres roughly bisected by the Lolo Creek drainage. It ranges in elevation from 3,200 feet near the eastern boundary to as much as 8,000 feet. Dominant relief within the drainages of the main tributaries, however, is 1,000 to 2,000 feet. Ridges between many of the deeply entrenched drainages are broad and rolling. Thick glacial tills are found in places on these ridges and slopes indicating a relationship to the Bitterroot Glacial Modified Subsection to the south.

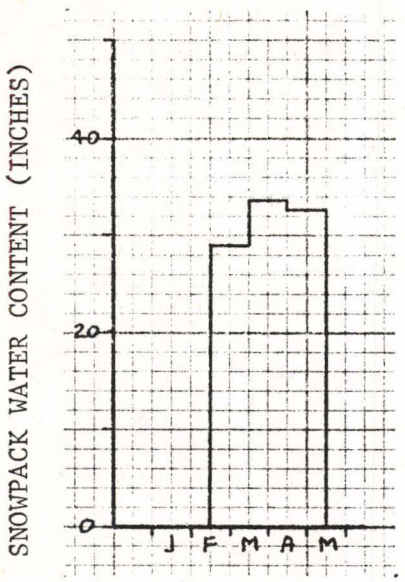
Bedrock is dominantly of the Belt Super Group (mainly Ravalli, (pc12) and Wallace formation (pc13). Some metamorphose (Pritchard formation (Mpc11) occurs in the southeastern part of the area. Rocks of the Idaho Batholith outcrops in the southwestern part of the area. The Lolo Hot Springs Batholith appears to be a shallow body of quartz monzonite and granite which is intruded into the low-grade metamorphic rocks mentioned above. The Hot Springs pluton appears to be the most recent in the area.

Annual precipitation ranges from 25 to 50 inches with runoff from less than 10 to 30 inches. Figure 1 shows the range in precipitation that can be expected from 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.8-2.2
10	24	2.8-3.2
25	24	3.2-3.8
10	6	1.5-1.7
25	6	1.6-2.0

Figure 2 shows the average water content of the snowpack at Lolo Pass from the middle of February to the middle of March.

Figure 2



LOLO PASS
ELEV. = 5250

Section V - Bitterroot Front Section

The Bitterroot Front Section contains over 1,000 square miles, extending from Lolo Creek 60 miles south to the Nezperce Fork of the Bitterroot River.

It consists of two subsections:

Map Symbol	Subsection Name	Range in Elevation	Dominant Local Relief	Median Elevation
1.	East Slope Bitterroot Range Subsection	4000-10000	2000-4000	7000
2.	West Slope Bitterroot Range Subsection	2600-8500	2000-3000	5800

This section is comprised of a remarkably straight and even north-south trending mountain range, which is strong evidence of uplift and/or faulting.

Langton's sequence of structural development in the area follows:

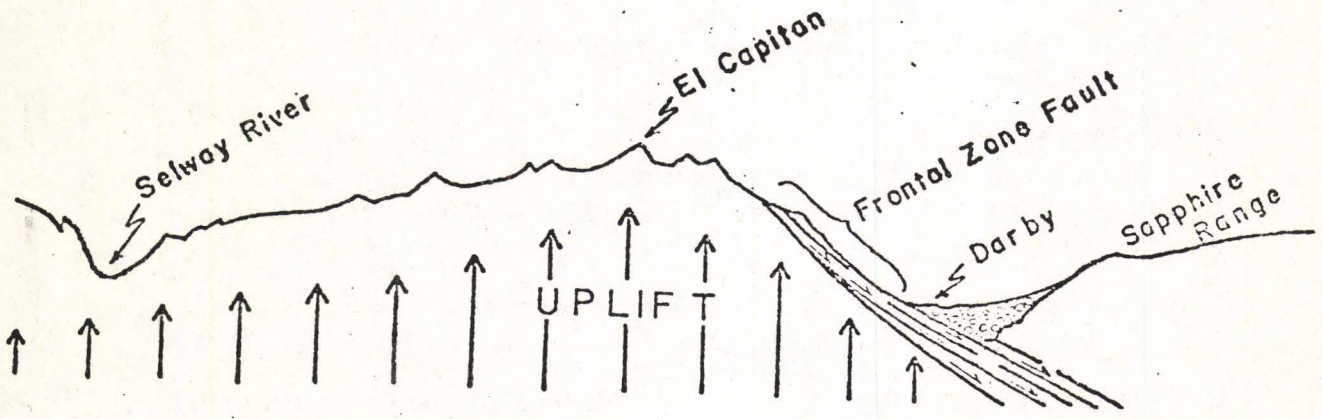
1. Development of the large north-south trending Bitterroot thrust fault, dipping eastward and probably contemporaneously with the upthrust faults bounding the linear ranges in northwestern Montana.

2. Batholithic intrusion within the Bitterroot Range, with contemporaneous development of the series of overthrust faults and tear faulting along the older faulted and weakened zone, together with the dragging of the gneiss and bending of the faults to the south.

3. Normal faulting. This produced, at least in part, the slickensides and a granulation of the gneissic zone by sinking of the valley and uplift of the range along the zone which had been weakened previously by thrust faulting, intrusions, and tearing.

This complex history perhaps in part accounts for the considerable subsidence of the floor in a valley so narrow that its fill, ordinarily, would be easily supported by the strength of the earth's crust.

The following figure is a hypothetical cross section using Langton's ideas.



Hypothetical cross section: Bitterroot Mountains, Bitterroot Valley and the Sapphire Mountains, V.E.=8x (Winegar, 1974).

The geology has been aerially mapped as mostly undifferentiated granitics of the Idaho Batholith on almost the entire West Slope Subsection (except for a small portion of Pre-Cambrian Belt rock-mainly schists, quartzites, and gneisses). From available information, it appears that quartz monzonite dominates over granodiorite with a wide variety of grain size and degree of mineral (gneisses) orientation. Quartz diorite is a common inclusion, as are felsitic dike swarms. About two-thirds of the east slope subsection has about the same suite of granitic rocks as the west slope subsection, although more gneissic characteristics have been noted in the former. The other one-third of the subsection is the "Front", which consists mainly of gneisses with some schists, and in the north, Pre-Cambrian metasediments (quartzites, schists, and gneisses). Dominant within-canyon relief on the east side is generally 3,000 feet or over. Dominant within-canyon relief on the west side is about 2,000 feet, although 3,000 feet relief is the rule south of Cove Peak on the west side subsection.

About 70 percent of the section is in the Strongly Glaciated Landtype association. About 5 percent of the lower elevations in the southwestern portion of the unit is in the Fluvial Landtype association. About 15 percent of the area on the "dip" slopes along the truncated "Bitterroot Front" is also in the Fluvial Landtype association. About 5 percent is in the Frost Churned "cryic" Landtype associations. This association occupies small, scattered bands at elevations between the two main landtype associations. Another 5 percent of the section is in the Depositional Landtype associations.

Soils are chiefly moderately coarse to coarse textured on most parent materials, except for some shistose parent materials and some mixed depositional parent materials. Soil depth is highly variable depending on land form and slope position. Many soils are stoney to gravelly.

This section contains a wide variety of habitat types, both in the Douglas fir (four are common) and subalpine fir (four are common) series and even two in the grand fir series. These plus the communities associated with the subalpine fir/whitebark pine barrens at 9,000 feet and above, make for a rather wide diversity of life.

As would be expected, a mountain range of this size has some marked rain-shadow effects. The amount of moisture received on the east slope subsection is significantly less than received by the west slopes. (It should be noted here that average annual rainfall information summarized on maps for Idaho and Montana does not match at the State boundary.)

Subsection 1 - East Slope Bitterroot Range Subsection

The East Slope Bitterroot Range Subsection is about 400,000 acres bounded on the west by the Bitterroot Ridge (also the Idaho-Montana State line) and on the east by the Bitterroot Valley. Although the exact nature of the processes involved is still being discussed, the "Front" characteristics of this subsection are obviously due to relatively local structural changes which are of a high order of magnitude and relatively recent. The two dozen or so perennial drainages all drain well expressed glacial troughs with moderately to strongly developed cirque headlands. The area contains more than 80 small alpine lakes.

Elevation ranges from about 4,000 feet at the edge of the valley to over 10,000 feet at Trapper Peak. Relief within the drainages is dominantly about 3,000 feet (ranging from about 2,000 to 4,000 feet).

Bedrock in the area is almost two-thirds granitics. These are exposed in the main ridge and in the entrenched glacial troughs. An extensive network of dikes intrudes the granitics in many places and these are mostly felsic (commonly quartz latite). These dikes seem to be associated with the thrust faults which are associated with the Batholith. Some of the granitics, especially in the southern portion of the subsection have gneissic characteristics which have been variously identified by workers in the area.1/

The eastern Bitterroot dip slopes which occupy the somewhat truncated spurs between drainages are mainly genisses. Ross (1950) has identified these as granitize, gneissic rocks which were formerly sedimentary, similar to other "border zone" rocks adjacent to the Idaho Batholith elsewhere. He hypothesizes that they once covered a good deal of the Batholith rock in the area and associates them with other "border zone" rocks in the Sapphire Range. Figure 1 shows this relationship.

1/ Winegar, R. C., Bitterroot II Geologic Survey. p. 183

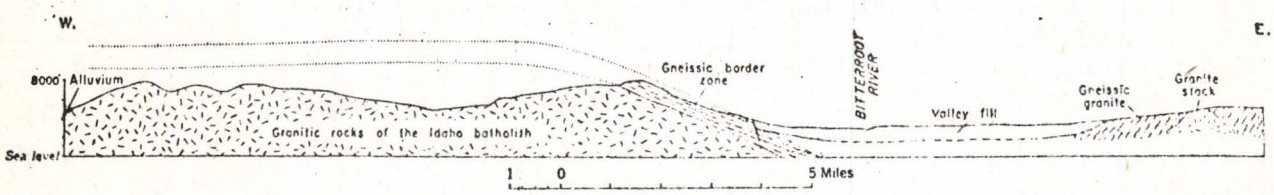


Figure 1. Hypothetical cross section: Bitterroot Mountains (Ross, 1950)

Winegar (1974) proposes the following sequence to further explain the situation:

1. Age of the frontal zone granite is uncertain. It is predeformation, perhaps dating back to the Precambrian, but a better assumption is that it is an early Cretaceous intrusion--perhaps contemporaneous with beginning uplift of the Bitterroots.

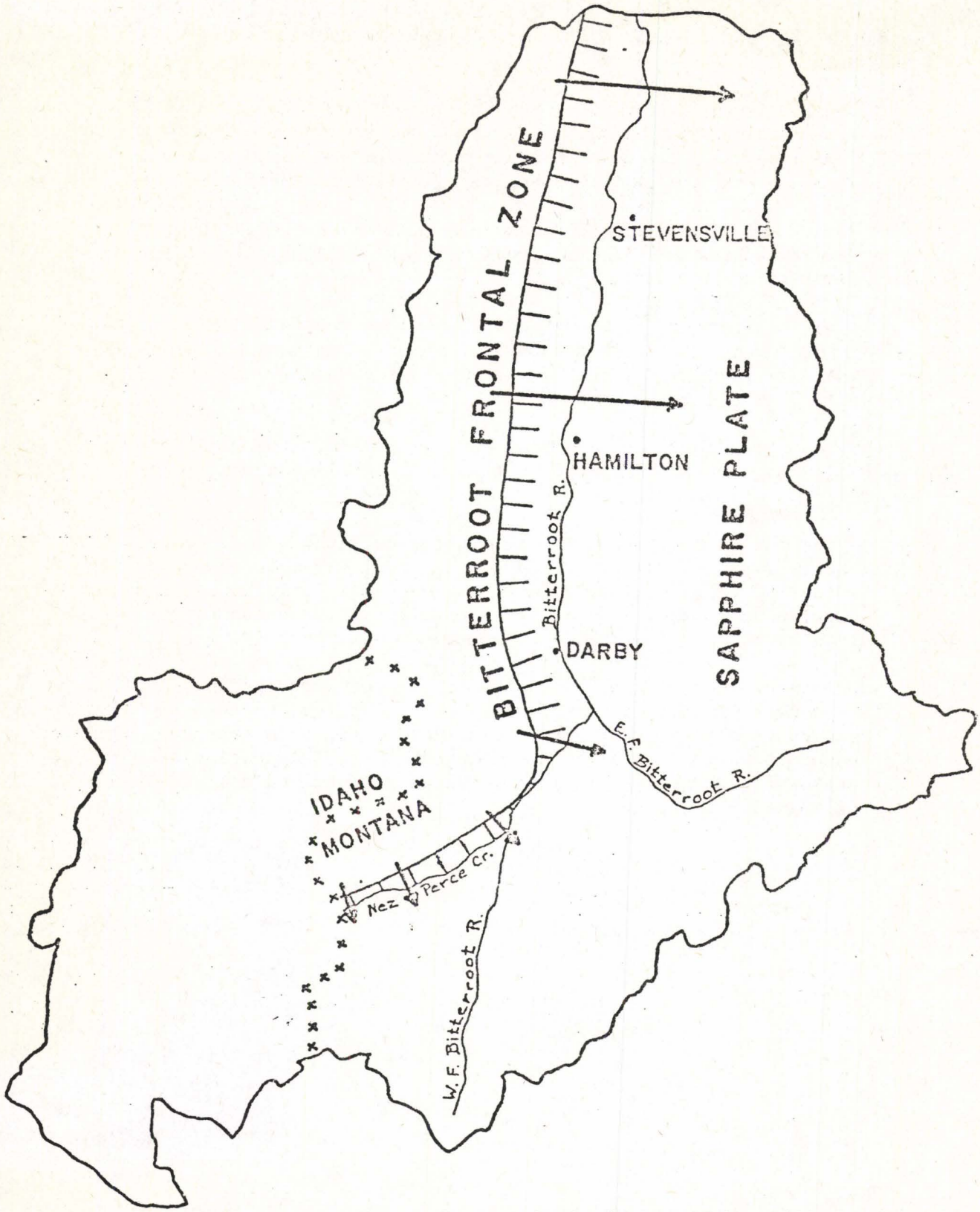
2. Continued uplift causes the Sapphire plate to begin movement. Shear deformation forms in the frontal zone gneiss and frontal zone granite.

3. After the shearing and movement of the Sapphire plate was complete or at least progressed further east, intrustion of a late Cretaceous granite (ki) occurred. This granite could indeed be Tertiary in age.

4. The transecting normal faults develop, creating the en echelon contact pattern between the granite (ki) and the gneiss (gn).

Erosion remained active and formed the topography we see today. Possibly during or shortly after this, fault movement was subsiding and shallow intrusions of predominantly quartz latite were emplaced. These intrusions often broke through to the surface and formed the volcanic deposits (mainly in Subsection 9, Section III).

The frontal zone granite may represent the original parent magma. The younger granite, the intrusive quartz latite, and the volcanics could be later phases of crystallization of the same material. The younger rocks in general seem to be more felsic suggesting differentiation of the original granodioritic melt to silica and alkali-rich magmas.



General tectonic map of the Bitterroot National Forest. Arrows show direction of movement of the Sapphire plate (Winegar, 1974)

An area on the northern end of the subsection is comprised of Precambrian metasediments (mainly Pritchard and Ravalli group). These are commonly schists gneisses with some quartzites.

All the main drainages in the subsection show moderately (in the northern quarter) to strongly developed glacial trough and cirque headland characteristics. This puts almost 65 percent of the subsection in the Strongly Alpine Glaciated Landtype association. Several periods of glaciation have been identified by all the workers in the area. Soils in these landtypes have dominantly sandy loam to loamy sand textures. Soil depths are variable but many are shallow on the upper trough slopes and even on whole slopes where ice action has scoured the entire slope. Some slopes have been plastered with glacial till and these slopes may have deep soils. Most of the soils are stony in this landtype association. The soils from the metasediments are medium to moderately coarse textured and in many places are deeper and less stony than the soils developed from the other parent materials in the Strongly Glaciated Landtype association.

About 20 percent of the area is in the Fluvial Landtype association. This occupies mainly the Bitterroot Front "dip" slopes between the glacial troughs and the lower slopes in the northern part of the subsection. Soils on the front "dip" slope portion are dominantly moderately coarse textured, shallow to moderately deep stony soils. In the northern part they are moderately deep to deep, medium to moderately coarse textured, and tend to be less stony than the "dip slope" soils.

About 5-10 percent of the area is on Frost Churned (cryic) slopes at elevations generally between 7,000 and 8,000 feet. This is generally a very narrow band on these steep slopes and could easily be mapped with either of the other landtype associations, depending on the situation.

About 5-10 percent of the area is in the Depositional Landtype association from moraines, valley train, alluvial fans, and slope wash fans. These lands contain a rather wide variety of soil materials and characteristics. Some morainal materials are subject to mass movement in zones of moisture concentration.

The dominant habitat type on drier intermediate slopes is Douglas fir/pinegrass. Douglas fir/bluebunch wheatgrass is on the lowest south slopes with Douglas fir/pinegrass (Kinnikinnick phase) on terraces. Subalpine fir/woodrush and subalpine fir/beargrass are at higher elevations. Subalpine fir/beadlily and subalpine fir/menziesia are dominant on the bottoms and lower slopes, respectively.

Average annual rainfall ranges from 30 to 100 inches and runoff from 5 to 40 inches.

Subsection 2 - West Slope Bitterroot Range Subsection

This subsection is an area of about 300,000 acres made of mostly the Strongly Glaciated Lands west of the Montana-Idaho divide formed by the main ridge of the Bitterroot Mountains.

Elevation ranges from less than 4,000 to over 8,500 feet south of Cove Peak. North of Cove Peak elevation ranges from about 6,000 to 8,500 feet.

About 85 percent of the central portion of this unit has been identified as Batholith granitics. According to present information, most of it is quartz monzonite, a portion of which is fine grained. Granodiorite and quartz diorite gneiss have been mapped in the headwaters of the Lochsa River as have areas of Precambrian rocks, chiefly schists and gneisses and quartzites of the Pritchard formation. Gneisses have also been identified in the southernmost portion of the subsection. Felsic dike swarms are also found in this subsection.

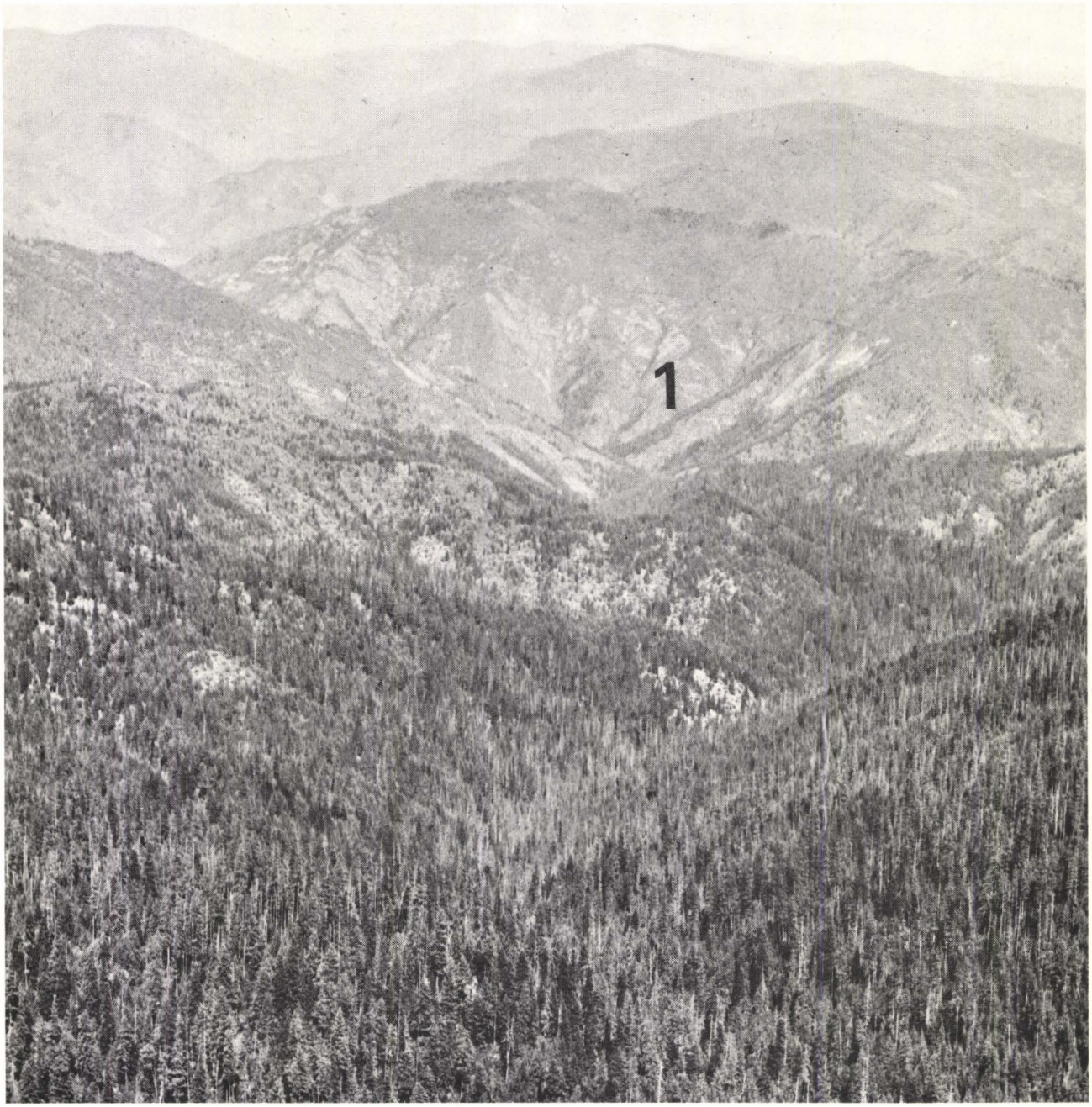
Except for some of the rejuvenated canyon slopes in the southern part of the subsection, almost the entire area is in the Strongly Glaciated Landtype association. About 60 or 70 percent are Glacial Troughs.

Soils formed from granitic parent materials have dominantly sandy loam to loamy sand textures. Soil depths are variable but many are shallow on the upper trough slopes and even on whole slopes where ice action has scoured entire slopes. Some slopes have been plastered with glacial till and these slopes have deep soils. Many of the soils are stony. The soils from the Pritchard formation are loams to sandy loam and in many places are deeper and less stony than the soils from granitics.

At lower elevations on north slopes grand fir/beargrass is a common habitat type with grand fir/clintonia common in the bottoms. Douglas fir/beargrass and Douglas fir/ninebark are the south slope habitat types at lower elevations with Douglas fir/bluebunch wheatgrass common at the lowest elevations. Higher elevations habitat types include subalpine fir/beargrass, woodrush, dwarf huckleberry with subalpine/fir menziesia in draws at intermediate elevations.

Average annual precipitation ranges from about 40 to 100 inches and runoff from about 20 to 70 inches. This area constitutes the chief water producing areas for the Selway and Lochsa Rivers. The following shows the range in precipitation that can be expected from 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	2.2-2.5
10	24	3.0-3.4
25	24	3.8-4.0
10	6	1.6-1.9
25	6	2.0-2.2



North Fork Clearwater Rejuvenated Canyonlands
Subsection in St. Joe-Clearwater Section (VI-1).

Section VI - St. Joe-Clearwater Section

This section contains almost 5,000 square miles. It encompasses the entire St. Joe drainage as well as portions of the St. Maries, North Fork of the Clearwater, and Little North Fork of the Clearwater drainages. The northern portion drains into the Clarks Fork and Coeur d'Alene Rivers. Elevation ranges from about 2,000 feet near St. Maries to about 8,000 feet in the Bitterroot Strongly Glaciated Lands Subsection. Local relief varies considerably in the ten subsections which have been identified.

Map Symbol	Subsection Name	Approximate Median Elev.	Dominant Local Relief
1.	North Fork Clearwater Rejuvenated Canyonlands Subsection	4,200'	3,000-3,500'
2.	Deception-Hoodo Basin and Uplands Subsection	5,000'	1,500-2,000'
3.	Bitterroot Strongly Glaciated Lands Subsection	6,500'	1,500'
4.	Lolo Strongly Dissected Lands Subsection	4,400'	1,500-2,000'
5.	Wade Peak Subsection	5,200'	2,000'
6.	Upper St. Joe Strongly Dissected Lands Subsection	4,800'	2,500-3,000'
7.	Sisters Basin & Uplands Subsection	4,300'	1,500-2,000'
8.	Marble Mountain Strongly Dissected Uplands Subsection	5,500'	2,000'
9.	Baby Grand Low Relief Uplands Subsection	3,800'	500/1,000-2,000'
10.	St. Joe Thrust Fault Lands Subsection	4,400'	2,500-3,000'

Structural control is still exerted by Precambrian north-northwest trending folds and faults. These have been subsequently modified by faulting (block and thrust) and folding.

Bedrock is primarily in the Belt Super Group with minor amounts of small igneous intrusions ranging from quartz diorites or gabbro (in the northwestern part of the area). Some small granitic plutons have also been identified. Sills and dikes of porphyritic intermediate rocks have been noted. Tertiary volcanic rocks include the intermediate rocks exposed

in small areas in the east-central part of the area and the eastern edge of the Columbia River basalt flows in the southwestern part of the area. Rocks of the Belt Super Group are dominantly gneisses and schists, quartzites and argillites, with minor amounts of limestone and dolomite. Metamorphism increases from east to west.

By far the largest area in the section is in the Fluvial Landtype association. The Alpine Glaciated Landtype associations are restricted to the highest ridge systems and account for less than 10 percent of the area. Frost Churned (cryic) Landtypes are most prevalent above 6,500 feet and are strongly expressed above 7,000 feet. Many landtypes in this section have aeolian mantles one to two feet thick. This fact, plus the character of the dominant Belt Super Group (except for some argillites and quartzites), tends to yield silt loam to heavy loamy soil textures.

The presence of hemlock, cedar, and mountain hemlock series reflect the influence of maritime climate not present in the southern sections.

This section does not have any significant mountain barriers to impede the normal movement of moisture-laden air masses from the Pacific Ocean. Most of the total annual precipitation is brought in from the west by cyclonic storms.

Average annual precipitation ranges from 19 inches on the eastern fringes of the section to over 70 inches in the high, mountainous country. Average annual precipitation for the entire section is 46.70 area-inches.

The St. Joe-Clearwater Section has a typical wet winter and dry summer climate. Most precipitation occurs between November and March. Cyclonic storm activity from the Pacific Ocean produces approximately 60 percent of the total annual precipitation during this period. The driest months are July and August. Approximately 6 percent of the annual precipitation occurs during this 2-month period.

As with most snow course data, April 1 surveys generally find the highest winter water content. April 1 snowpacks contain approximately 50 percent of the total annual precipitation.

The average annual maximum, mean, and minimum air temperatures for this section at median elevation are 52.5°F., 40.7°F., and 28.7°F., respectively. Maximum-minimum variation is 23.8°F.

The relatively warm temperatures and low maximum-minimum variation is largely due to the maritime influence of the Pacific Ocean. The median elevation of this section is relatively low, which also results in warmer temperatures. The elevational relief within the section is 5,000 feet. This can result in about 17°F. temperature differences between the lowest and highest areas at any one time.

Growing seasons within the Coeur d'Alene River valley range from approximately 140 days at lower elevations (less than 2,300 feet) to less than 50 days within the headwaters. The St. Joe River valley has a growing season range of about 130 days at the lowest elevations (St. Maries) to less than 30 days within the headwaters. The high elevation terrain of the Bitterroot range has a growing season of less than 10 to 20 days.

Average annual runoff from the section is 26.14 area-inches (6,831,000 acre-feet). This accounts for 56 percent of the average annual precipitation. Average annual runoff ranges from 1 to 65 inches.

The section utilizes 20.56 area-inches (5,373,000 acre-feet) of water annually for evapotranspiration. This is equivalent to 44.0 percent of the average annual precipitation. Although the total amount of water lost to evapotranspiration is high, the percent loss is low.

North Fork Clearwater Rejuvenated Canyonlands Subsection (VI-1). Slopes in foreground have anorthosite bedrock. White spots are slope failures whose frequency was probably increased after the fire.

Subsection 1 - North Fork Clearwater Rejuvenated Canyonlands Subsection

The North Fork Clearwater Rejuvenated Canyonlands Subsection is 330,000 acres of strongly dissected, extremely steep, high relief canyon and ridge lands. The strong structural control on the drainage patterns is clearly expressed from the AMS topographic map. Although the literature denotes an extremely complex structural history of large-scale folding and intermittent faulting activities, there are some indications that these sporatic activities have extended into the tertiary with the possibilities of localized block faulting of even more recent times.

Elevations range from 2,000 to almost 7,000 feet. Dominant relief is about 3,000 to 3,500 feet.

Bedrock in the area belongs dominantly to the Precambrian Belt Super Group with some granitics in the south-central portion. Dominant lithologies are Prichard equivalent rocks in the northwest, Wallace equivalent rock in the northeast and south and Idaho Batholith (quartz monzonite, (Ki3c) in the central part. Larsen and Schmidt's (1958) road log shows a band of quartz diorite (ki2a) which is covered to the north by undifferentiated Belt rocks (mpCi). The quartz diorite is most likely the roof facies of the Batholith. The Hamilton linear map shows a strong northwest linear trend (which is related to the Trans-Idaho Discontinuity) through much of the subsection.

Landforms in the area generally reflect the accelerated (rejuvenated) processes, not only in the main river breaks but also in the tributaries. Except for the scattered "old surface" remnants generally at 5,000 to 6,000 feet elevations, the ridges tend to be sharp rather than rounded. The headlands of many drainages above the main canyon appear to have been weakly glaciated and show evidence of periglacial processes.

Soils on north and east aspects are typically 4 to 8 feet in depth and have a 1- to 2-foot loess cap. Typically the soils on the north and east aspects have rather ill-defined profiles and have 50 or more percent of rather competent coarse fragments generally 3 to 10 inches in size. Surface textures are dominantly silt loam. Subsoils are silt loam with sandy loams. Some of the soils tend to be slightly plastic in wet spots and in areas of more highly weathered bedrock. As might be suspected in the faulted areas, the middle and lower slopes contain numerous inclusions of areas which have a high mass wasting potential, especially those with more cohesive soils and/or in areas that are much less well drained internally.

South and west aspects are dominantly sandy loams and shallow to moderately deep, 1 to 3 feet thick. The loess cap on these exposures is very weakly expressed to absent. Habitat types range from mountain hemlock/pachistama to cedar/lady fern with cedar/devils club in the draws and grand

fir/pachistima with patches of Douglas fir/ninebark on the southwest aspects which have thin soils. There is little evidence of overland flow in this unit. Subsurface flow rates are rapid. Hazards to blowouts in the draws are highest in those that have thick accumulations of detritus. The most north and east slopes contain some of the most productive timber lands on the Forest, mainly in the cedar habitat types. Many of the mass wasting problems connected with road construction and on the Forest have been found in this subsection. The salient character of some of the lands in this subsection make safe road location and design particularly difficult.

The soils in the southeastern portion of the subsection tend to be less micaceous and have soil textures ranging from medium sandy loams to silt loams.

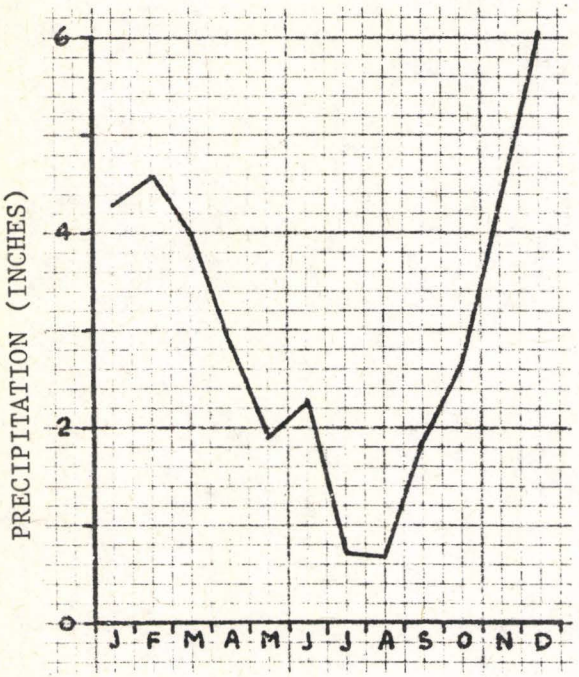
Subsoils in the area underlain by the granitics are mainly loamy sand over well weathered (weathering class 5) bedrock.

Average annual precipitation ranges from about 50 to 60 inches with runoff from 30 to 50 inches. Figure 1 shows the range in precipitation that can be expected from 6- and 24-hour storms for selected expected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	2.0-2.6	
10	24	2.8-3.6	
25	24	3.6-4.2	3.4
10	6	1.6-1.8	
25	6	1.9-2.1	

Figure 2 shows the distribution of precipitation by months for the Bungalow Ranger Station at 2,285 feet elevation. Figure 3 shows the average maximum, mean and minimum temperatures. Figure 3 describes a fairly warm canyon bottom.

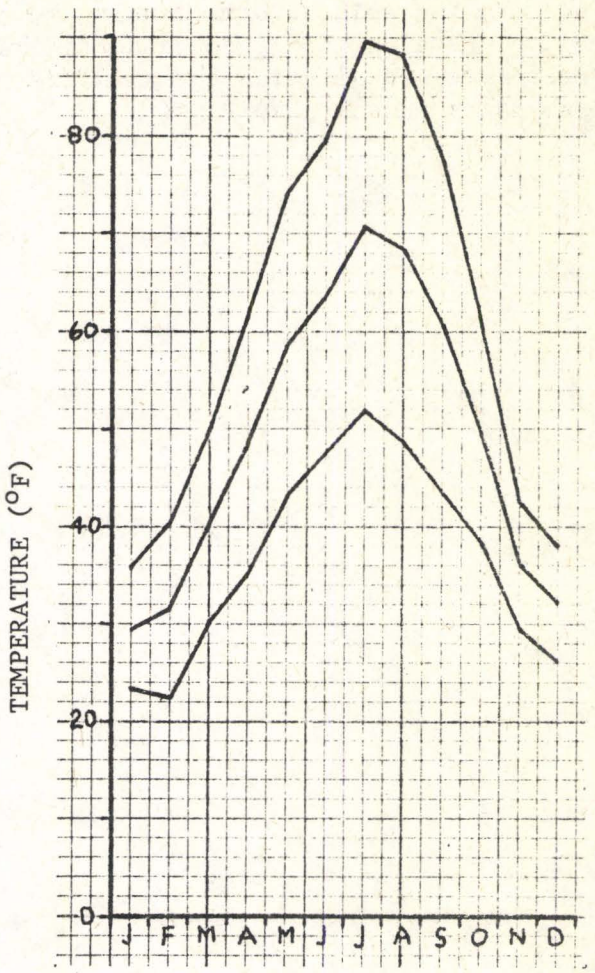
Figure 2



MONTHS

BUNGALOW R.S.
ELEV. = 2285
YEARS = 30
M.A.P. = 36.30

Figure 3



MONTHS

BUNGALOW R.S.
ELEV. = 2285
YEARS = 9
61.6-49.1-36.6

The challenges to management of the steep slopes of this subsection involve mainly taking into consideration their inherent stability problems. This is true, especially so in road building activities. Many problems can be readily avoided through proper analysis of existing geologic, landform and soil information in the planning process. The same information, plus habitat type data, can be used to more properly optimize vegetative manipulation for wildlife enhancement and for protection of high-value aquatic habitats.

Subsection 2 - Deception-Hoodo Basin and Uplands Subsection

The Deception-Hoodo Basin and Uplands Subsection encompasses about 270,000 acres of the headlands of the North Fork of the Clearwater drainage. The area appears to be a complexly uplifted surface with evidence of having been strongly glaciated in early Pleistocene (perhaps pre-Wisconsin times). It has massively glaciated valleys and rounded ridges probably during the same period that the Bitterroot Glacially Modified Subsection (Subsection 5, Section IV) was covered by a thick ice cap. When the more recent alpine (but less extensive) glaciation took place to the east in Subsection 3, this area underwent extensive frost churning and mixing characteristics of periglacial lands so that now lands above 5,000 feet have frost churned characteristics which mask most of the earlier glacial activities.

Elevations range from about 3,000 feet at Kelly Creek Work Center to 7,000 feet on a few ridges.

The area has been differentially uplifted and consequently has been entrenched to varying degrees by the included drainage systems. For example, in Cayuse Creek the dominant relief is 2,500 feet; in upper Kelly Creek relief is about 1,500 feet; in upper North Fork Clearwater relief is about 2,000 feet. In Deception Basin, a 40,000-acre area drained by Moose, Swamp and Little Moose Creeks, dominant relief is only a little over 1,000 feet.

The Deception Basin area has been uniquely protected from the geologic erosion that the rest of the subsection was exposed to. It appears to be a collapsed dome, that when first uplifted diverted the North Fork of the Clearwater westward, and thus was only exposed to the erosional processes from runoff actually collected within the area. Protected thus from erosional processes is perhaps the reason for the remnant evidence of early glacial activity on the ridges and the thick deposits at lower elevations of outwash from later glacial activities.

The older land surfaces on the upper broad ridges, though distinctly frost churned, have evidently been in place so long that many of the coarse fragments have been weathered to soil materials. Above 5,800 feet however, coarse fragments do increase in most profiles. Bedrock in the Deception Basin area is a weakly metamorphosed, well weathered quartzite. Metamorphism is so weak that some of the rock appears more like a sandstone. Soils are deep medium sandy loams to loamy sands. Loess caps up to 2 feet thick are found in protected saddles and concave slopes, but most generally the loess is mixed in the surface 2 feet. The drainage pattern is strongly dendritic and north facing slopes appear somewhat rejuvenated.

Hydrologic responses are quite slow and general and the older early Pleistocene land surfaces are becoming rapid on the rejuvenated lands of

the late Pleistocene. Problems have been experienced in road construction in the area where the two land surfaces meet. The large amounts of subsurface water moving through the deep soils of the old land surface are rapidly forced to the surface where the young and old surfaces meet.

Habitat ranges dominantly from subalpine fir/Menziesii on the ridges, to cedar/clintonia on the midslopes and north facing breaks with Douglas fir/ninebark and some grand fir/clintonia on the south and west facing breaks.

Most of the northern part of the remainder of the area (outside Deception Basin) is underlain by rocks of the Belt Super Group with minor outcrops of granitics. Reconnaissance efforts in the southern portion of the area indicate more quartz monzonite-granodiorite of the Batholith than rocks of the Belt Super Group. The broad ridges and upper slopes have frost churned characteristics which have effectively masked much of the evidence of early glacial activities. Soils are dominantly deep (averaging perhaps 6 feet). The surface 2 feet consist of mixed loess cap, generally sandy loam in texture, with sandy loam to loamy sand subsoils containing 30-50 percent angular coarse fragments. The kind and character of the bedrock does not seem to influence the stability of these lands as much as it does in other subsections due perhaps to the thick, mixed soil mantle.

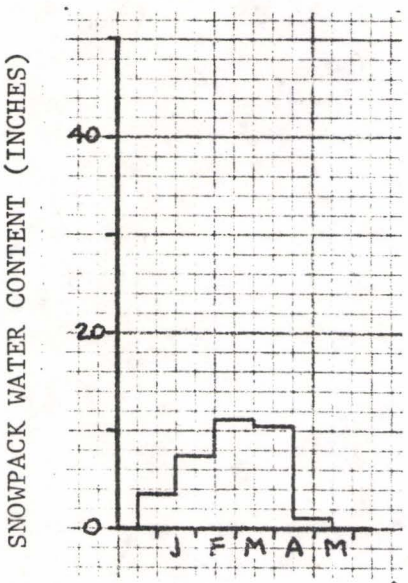
Slopes are dominantly convex in nature and most of the runoff is subsurface with widely spaced drainages indicating that the flow tends to be dispersed rather than concentrated. Again, the most hazardous lands are where the rejuvenated slopes meet the old upland surfaces. Timber productivity is medium to moderately low when compared to other lands on the Clearwater National Forest.

Average annual precipitation ranges from 50 to 60 inches with runoff from 30 to 50 inches. Figure 1 shows the range in precipitation that can be expected from 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	2.2-2.4
10	24	3.2-3.4
25	24	3.8-4.2
10	6	1.7-1.8
25	6	2.0-2.1

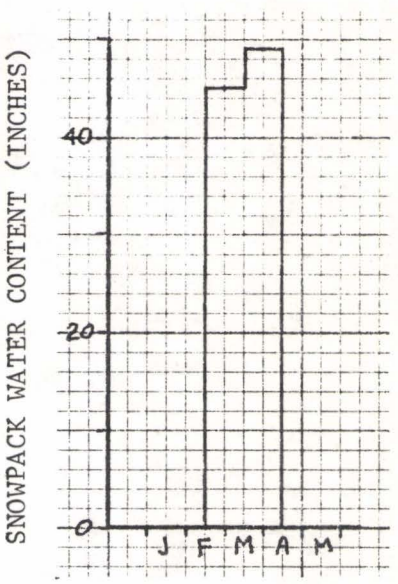
Figures 2 and 3 show the inches of water content for the snowpack at 3,700 feet (at Cayuse airstrip) and 6,600 feet (Goat Lake) giving some idea of the snow season in the area and the temperature effects of elevation.

Figure 2



CAYUSE AIRSTRIP
ELEV. = 3700

Figure 3



GOAT LAKE
ELEV. = 6600

Subsection 3 - Bitterroot Strongly Glaciated Lands Subsection

The Bitterroot Strongly Glaciated Lands Subsection is 150,000 acres of glaciated ridge system occupying the divide between Idaho and Montana north of the Lochsa River and between the elevations of about 4,000 and 8,000 feet. About 80 percent of the area, however, is between 5,000 and 7,500 feet. Almost the entire area is in the Strongly Glaciated Landtype association with numerous cirque basins containing more than three dozen lakes. Outstanding characteristics of the area are the relatively low ridges separating one cirque basin from another.

The generalized geologic information available for the area indicates that most of the bedrock in the area belongs to the Belt Super Group, probably Wallace formation and Ravelli group.

Average annual precipitation ranges from 60 to 70 inches with runoff from 40 to 60 inches. The following shows the range that may be expected from 6-and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	2.2-2.4
10	24	3.2-3.4
25	24	3.8-4.2
10	6	1.7
25	6	2.0

Subsection 4 - Lolo Strongly Dissected Lands Subsection

The Lolo Strongly Dissected Lands Subsection is approximately 300,000 acres lying to the west of Missoula and south of the Clark's Fork of the Columbia. The western half is drained mainly by Fish Creek and its tributaries and the eastern half by minor tributaries like O'Brien, Deer, Albert and Patty Creek. Elevations range from about 3,000 feet on the lower foothills near Missoula to about 6,500 feet near the Northern Bitterroot Range. Dominant relief within most tributaries ranges from about 1,500 to 2,000 feet. From the sketchy geologic information in the literature, bedrock in the area consists mainly of unmetamorphosed belts. (Mainly of the Ravelli group - St. Regis Fm./Revett Quartzite/Burke Fm.)

Terrace remnants from Pleistocene Lake Missoula are commonly found in the area bounding the Clark's Fork Valley at about the 4,000-foot elevation and below.

The dominant ridge systems are around 5,500 feet and above. These are broad and rolling and show evidence of past, weakly expressed frost churning (cryic) activities. Such ridge systems occupy about 20 percent of the area. About 70 percent of the area is in the Moderately Dissected Fluvial Landtype association between 4,000 and 5,500 feet, and the remainder is in the Weakly Dissected Lower Slope Landtype association.

Average annual precipitation ranges from about 20 to 50 inches with runoff from 25 to 30 inches.

Subsection 5 - Wade Peak Subsection

The Wade Peak Subsection is about 112,000 acres south of the Clark Fork River between Dry Creek and Meadow Creek. Dry Cedar and Trout Creeks have their headwaters in the Bitterroot Strongly Glaciated Lands Subsection. The area ranges in elevation from about 3,000 feet to about 6,500 feet. Dominant relief in most of the drainages is about 2,000 feet. The broad ridges separating the major tributaries are at about 6,000 feet elevation and like Subsection 4, show frost churned characteristics. The rest of the area is in the Weakly to Moderately Dissected Landtype association with minor amounts in the Depositional Landtype association. Lake Missoula terrace remnants are also found in this subsection at about the 4,000 foot elevation.

Average annual precipitation ranges from about 20 to 60 inches with runoff from 5 to 30 inches.

Subsection 6 - Upper St. Joe Strongly Dissected Lands Subsection

The Upper St. Joe Strongly Dissected Lands Subsection is about 260,000 acres occupying the St. Joe drainage above Skookum and Sisters Creek. It ranges in elevation from about 3,000 to 6,500 feet. Dominant relief within major tributary drainages ranges from 2,500 to 3,000 feet. Ridge systems are mainly about 5,500 feet and tend to be less rounded in the southwestern part of the area.

The St. Joe River follows the direction of the St. Joe strike-slip fault. Bedrock in the area is mostly the Wallace formation (low grade metamorphic rocks of the Belt Super Group). Some basalt flow remnants also occur near the river on the west. About 65 percent of the area is above 5,000 feet elevation which is the dominant elevation of where the slopes entrenched by streams meet the weakly to moderately frost churned ridge systems.

The north-facing slopes along the southern boundary have been moderately glaciated (less than 10 percent of the area). Most of the rest of the area is Weakly to Moderately Dissected Fluvial Lands and Stream Break Lands with some inclusions of Mass Wasting Lands.

Soils on the Frost Churned (cryic) Uplands typically have a 1- to 2.5-foot coarse silt loam loess cap overlying gravelly to cobbly sandy loam subsoils. On the highest ridges the loess may be thinner and/or mixed with the local soil parent materials. Where bedrock is highly micaceous, subsoil textures may be heavy loams to silt loams. Depth to bedrock is commonly 4 to 6 feet. These soils take in and percolate water rapidly and yield from 55 to 80 percent of the area's precipitation. Most of the runoff is subsurface. The loess caps erode readily when water is concentrated on the surface and slough readily when moisture seeps at the contact between the loess cap and less permeable materials in road cuts.

Dominant habitat types are subalpine fir/pachistima, menziesii and beargrass with some mountain hemlock/menziesii, beargrass and pachistima; cedar/pachistima at lower elevations.

Soils on the Strongly Glaciated Lands are generally thinner, contain more coarse fragments and have loess caps more apt to be mixed. Main habitat types are subalpine fir/menziesii, subalpine fir/beargrass, mountain hemlock/beargrass, and mountain hemlock/menziesii.

Soils on the Weakly to Moderately Dissected Fluvial Lands have 1/2- to 2-foot loess caps of silt loam to fine sandy loam textures overlying subsoils 5 to 8 feet thick of loam to dry loam textures and up to 30 percent coarse fragments.

Soils on the Stream Break Lands tend to be shallow and fairly coarse textured. On north and east aspects, soils are deeper and churned. On south and east aspects, soils are shallower and coarser. A loess cap, though present on north and east aspects, has been essentially eroded away on south and west slopes.

The loess caps on all these lands are in a rather precarious state of equilibrium and when undisturbed, this cap provides an effective filter through which water moves as shallow subsurface flow. But when water is concentrated in the form of surface flow, much erosion can occur. Also, in zones of natural subsurface moisture concentration, mass failure hazard is high and road building activities chancey.

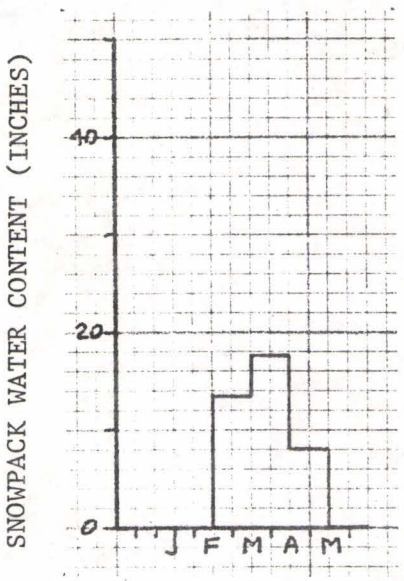
Chief habitat types are hemlock and cedar/pachistima on these landtype associations, with some grand fir/pachistima on south slopes. Douglas fir/ninebark may occur on the extremely rocky ridges.

Average annual precipitation ranges from 45 to 60 inches with 20 to 50 inches of runoff. Figure 1 shows the range in precipitation that can be expected from 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	2.2-2.4	
10	24	3.0-3.2	
25	24	3.0-3.4	2.8
10	6	1.4-1.7	
25	6	1.6-2.0	

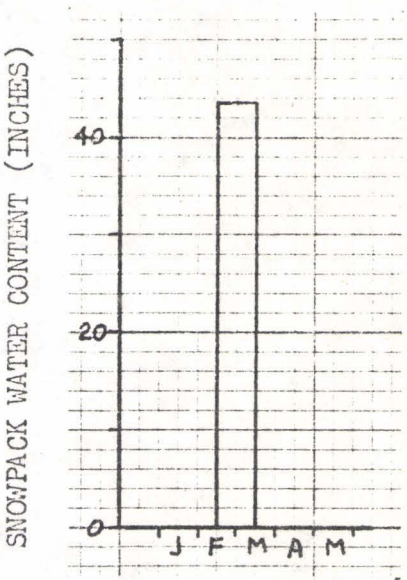
Figures 2 and 3 give the water content of the snowpack at Outlaw Creek and Medicine Ridge.

Figure 2



OUTLAW CREEK
ELEV. = 3750

Figure 3



MEDICINE RIDGE
ELEV. = 6150

Subsection 7 - Sisters Basin and Uplands Subsection

The Sisters Basin and Uplands Subsection is about 125,000 acres containing the upland divide between the headwaters of the Little North Fork of the Clearwater River and Sisters, Siwash and Fishook Creeks draining north into the St. Joe River. Elevations range from less than 3,000 feet on the river to over 6,000 feet at Snow Peak and Papoose Mountain. Internal relief within drainages ranges from 1,500 to 2,000 feet. About 40 percent of the area is above 5,000 feet, about 75 percent is above 4,000 feet and about 25 percent is below 4,000 feet.

Bedrock in the area is highly complex with mostly belt metasediments (Pritchard, Ravalli and Wallace rocks). The main ridge divide in the central part of the area is underlain by an outline of the Idaho Batholith (about 28,000 acres in extent). A small body (about 7,000 acres) of anorthosite is in the southern part of the area (see Maps IIa, IIF in Geology Report). Also, a couple of small outcrops of undifferentiated volcanics outcrop in the southern part of the area.

Using the Forest landtype association legend, about 50 percent of the area would be classed as Frost Churned (cryic) Uplands. Many soils on these lands have a 1- to 1 1/2-foot silt loam loess cap underlain by sandy to heavy loamy subsoils depending upon bedrock; depth to bedrock varies but is generally more than 4 feet. Habitat types are chiefly subalpine fir series with some cedar/pachistima and western hemlock/pachistima on warmer aspects.

About 30 to 35 percent of the area is in the Weakly to Moderately Dissected Fluvial Lands. Soils in these lands tend to have thinner loess caps than in the Frost Churned (cryic) Landtype association. Habitat types are dominantly cedar/pachistima, western hemlock/pachistima with some grand fir/pachistima on warmer sites. There are probably some inclusions of Mass Wasting Landtypes in this portion of the area. Subsoils here tend to be finer textured and in some cases, highly micaceous.

On northerly aspects above 5,000 feet some minor cirques and troughs occur. At low elevation adjacent to the St. Joe and in the main tributaries, considerable depositional lands occur.

Average annual precipitation ranges from about 35 to 50 inches with 20 to 40 inches runoff. The following shows the range in precipitation that can be expected for 6- and 24-hour storms at selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.8-2.4	
10	24	2.6-3.2	3.4
25	24	2.8-3.8	
10	6	1.3-1.7	
25	6	1.6-2.0	

This is an area of relatively high timber productivity. Chief hazards are associated with slump hazards on roads built on some of the steeper slopes in zones of moisture concentration.

Subsection 8 - Marble Mountain Strongly Dissected Upland Subsection

The Marble Mountain Strongly Dissected Uplands Subsection is about 118,000 acres in the generally north-south trending ridge system draining west and south into the St. Maries River and north and east into the St. Joe River. The area ranges from about 3,000 to over 6,500 feet elevation. Dominant relief with tributaries is generally over 2,000 feet. The major north-south ridge system has a median elevation of 5,500 feet. North and east facing slopes have moderately formed to weakly formed alpine cirques (some containing lakes) and short glacial troughs. These landtype associations occupy 5 percent of the area.

Frost churned slopes are mainly on the ridges and upper slopes and occupy almost half of the area. Soils in these areas are like those in Subsection 7 but occur generally at higher elevations. One- to 1-1/2-foot loess caps are common here. Subalpine fir/beargrass and menziesia western/mountain hemlock/menziesia are the dominant habitat types.

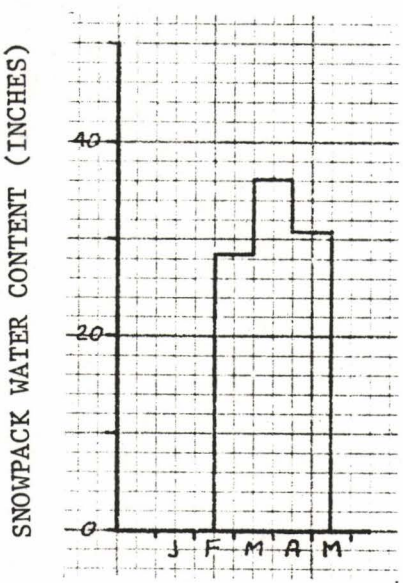
Most of the rest of the area is in the Strongly to Moderately Dissected Fluvial Lands. Slopes are steep ranging dominantly from 45 to 65 percent. Depth of the loess cap is variable on this landtype association and there are more places where it is absent entirely or completely mixed with other soil parent materials. Subsoil textures range from loamy sands on granitic areas to clay loam on some metasediment parent materials. Habitat types are chiefly cedar and western hemlock/pachistima.

Average annual precipitation ranges from 35 to 60 inches with 15 to 50 inches runoff. Figure 1 shows the range in precipitation that can be expected from 6- and 24-hour storms for selected return periods.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.8-2.2	
10	24	2.8-3.2	2.6
25	24	2.8-3.8	
10	6	1.3-1.7	
25	6	1.5-2.0	

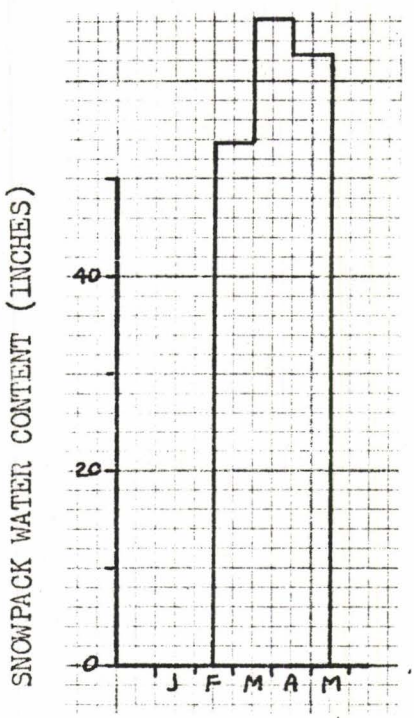
Figures 2 and 3 show the average water content for the snowpack at Forty-Nine Meadows and Lost Lake respectively.

Figure 2



FORTY-NINE MEADOWS
ELEV. = 5000

Figure 3



LOST LAKE
ELEV. = 6000

Subsection 9 - Baby Grand Low Relief Uplands Subsection

The Baby Grand Low Relief Uplands Subsection is an area over 1/2 million acres in extent and mostly drained to the north by the St. Maries River with the western portion drained to the south by the Palouse River. It ranges in elevation from about 2,500 feet to about 5,500 feet. Relief on the basalt flows is about 500 to 750 feet. In other places, relief is about 1,000 to 1,200 feet and in still other places as much as 2,000 feet. The overall appearance of the area, however, is one of low relief when compared to other subsections in the section.

Only about 12 percent of the area is above 4,000 feet and less than 5 percent is above 4,000 feet. The median elevation appears to be about 3,500 feet.

About 10 percent of the area could be classed as Weakly Frost Churned Land using the St. Joe Landtype association legend. About 15 percent is in the Steep Strongly Dissected Fluvial Lands and about 6 percent in the Weakly Dissected Fluvial Lands. About 10 percent of the area is in Basalt Plateau Lands (not recognized in St. Joe Landtype association legend). About 20 percent of the area is in Depositional Landtype association (both lake and stream deposits). The lake deposits were formed by the Columbia River basalts damming streams like the St. Maries River and Coeur d'Alene Lake. The lower St. Joe River, lower St. Maries River, and the St. Maries River valley near Santa, Fernwood, and Clarkia have a lacustrine history. Most of these lands have silt loam soils (which originated from loess) and very gentle slope gradients. Depth to bedrock is generally greater than 10 feet. Both volcanic ash loess and "normal" palouse loess are occasionally stratified in a single profile.

Loess caps on the rest of the area are commonly 2 feet thick--somewhat thinner on south slopes. In the southwest portion of the area underlying weathered mica schist bedrocks give rise to extremely thick mantles with high moisture holding capacities and high mass failure hazards.

Although all four major belt units are represented in the area, the Libby and Wallace formations dominate rocks in the western one-third of the area and are more strongly metamorphosed than on the western two-thirds.

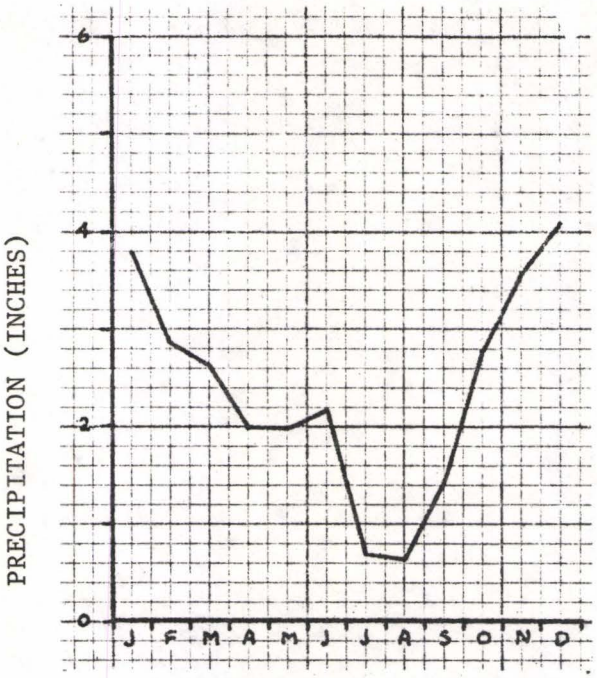
At lower elevations habitat types of the ponderosa pine, Douglas fir, and grand fir series are unevenly distributed. At intermediate elevations most of the area is in western hemlock/pachistima and the remainder in cedar/pachistima.

Average annual precipitation ranges from 30 to 50 inches and runoff from 10 to 30 inches. Figure 1 shows the range in precipitation that can be expected from 6- and 24-hour storms for selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.6-2.2
10	24	2.2-3.0
25	24	2.8-3.4
10	6	1.3-1.5
25	6	1.5-1.8

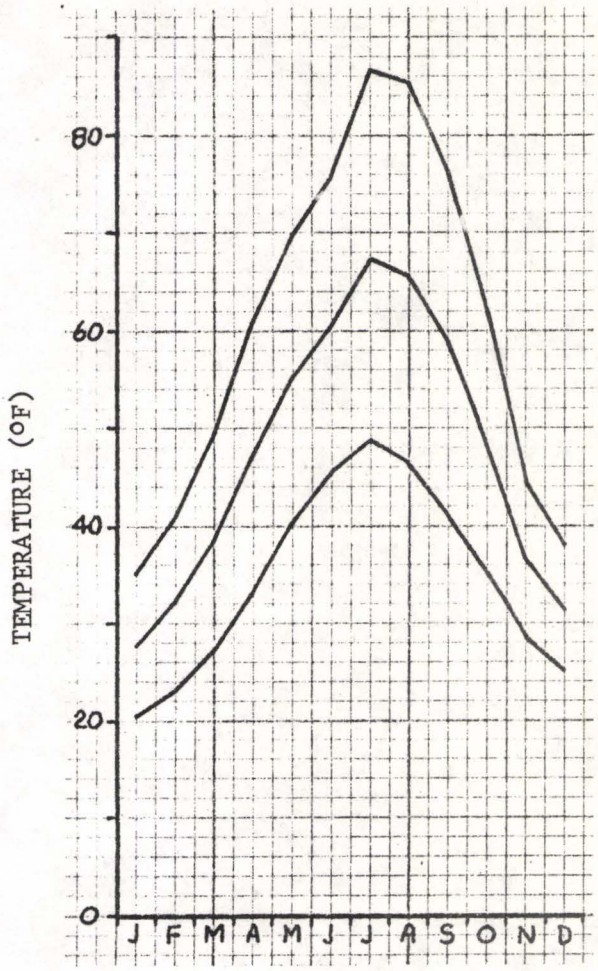
Figures 2 and 3 show the distribution of precipitation and the mean maximum, minimum, and average temperatures by months for St. Maries (elevation 2,155).

Figure 2



SAINT MARIES
ELEV. = 2155
YEARS = 30
A.A.P. = 23.71

Figure 3



SAINT MARIES
ELEV. = 2155
YEARS = 30
60.4-47.5-34.7

Subsection 10 - St. Joe Thrust Fault Lands Subsection

The St. Joe Thrust Fault Lands Subsection is about 1/2 million acres consisting mainly of the St. Joe Mountains draining north into the St. Regis and Coeur d'Alene Rivers and south into the St. Joe River. Elevations range from about 2,100 feet on the St. Joe and Coeur d'Alene Rivers to a little over 6,000 feet on peaks of the main ridge. Dominant local relief ranges from 2,500 to 3,000 feet. Only about 15 percent of the area is above 5,800 feet. About 40 percent of the area is below 3,000 feet.

Bedrock in the area is mostly the Belt Super Group which has been discussed elsewhere. Several small stacks of quartz monzonite intrude the belt rocks as do dikes of aplite, diorite, dacite, and lamprophyres.

This subsection represents an area in which the belt rocks have been more strongly deformed than they have in adjacent areas. Most of this deformation (folding, tilting, etc.) is associated with the Osborn Fault which has affected lands in the South Fork of the Coeur d'Alene, St. Regis, and part of the Clarks Fork Rivers. The St. Joe Fault bounding the area on the south has also affected lands in this subsection.

Information on hand now indicates quartzite rock is dominant. Schists and gneisses are also common. Where schists are highly weathered, they can provide soil materials high in mica which are generally associated with both good productivity and slump failure hazards.

Some slopes in this subsection are deep slopes where the bedrock bedding plane is roughly parallel to the direction of the slopes. Some of these kinds of areas also have their particular sets of problems.

Most of the headlands above 5,000 feet draining north show moderate to weak evidence of alpine glaciation (cirques and glacial troughs). Most of the upper slopes and ridges around 5,000 feet in elevation show frost churned (cryic) characteristics. More than one-half of the area is in the Weakly to Moderately Dissected Fluvial Landtype association. The rest of the area is comprised of Depositional, Stream Breaks, Mass Wasted and Depositional Scarp Slope Landtype associations (see Appendix for St. Joe Landtype association legend).

Soils in the area are dominantly 3 feet or more in depth and consistently have a 1- to 1 1/2-inch loess cap even on 60 percent north facing slopes. On south slopes the loess cap is generally less than 1 foot thick and may be absent on south facing scarp slopes.

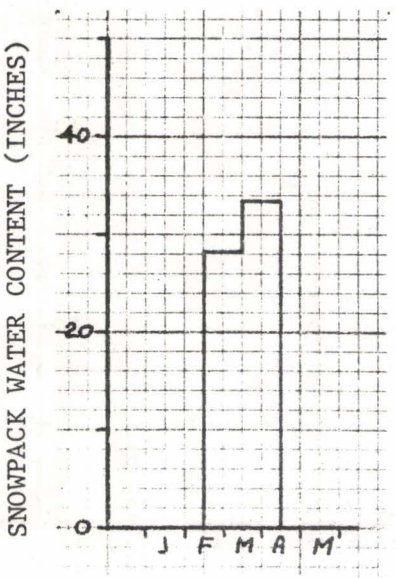
Cedar habitat types predominate the intermediate elevations. Grand fir occupies only the drier, shallow soiled south and south-westerly slopes. Subalpine fir habitat types dominate above 5,500 feet.

Average annual rainfall ranges from 30 to 70 inches with 10 to 40 inches runoff. Figure 1 shows the range in precipitation that can be expected for 6- and 24-hour storms having selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.8-2.2	
10	24	2.6-3.2	
25	24	3.0-3.8	2.8
10	6	1.3-1.7	

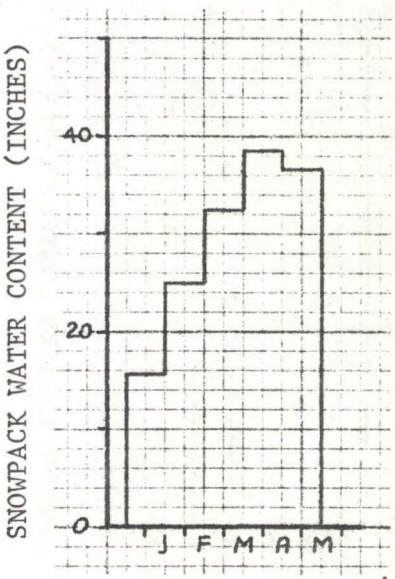
Figures 2 through 6 show the water content in inches of 5 snow courses going from west to east along the northern portion of the subsection. Figures 2, 3 and 6 are at similar elevations and show an increase in moisture to the east. The courses near Roland are at about the same longitude and show the effects of elevation on water content of snowpack.

Figure 2



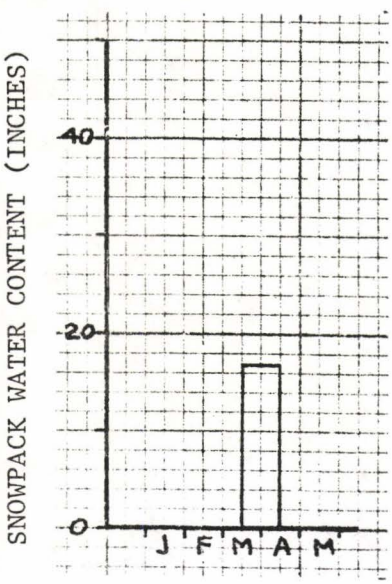
KELLOGG PEAK
ELEV. = 5560

Figure 3



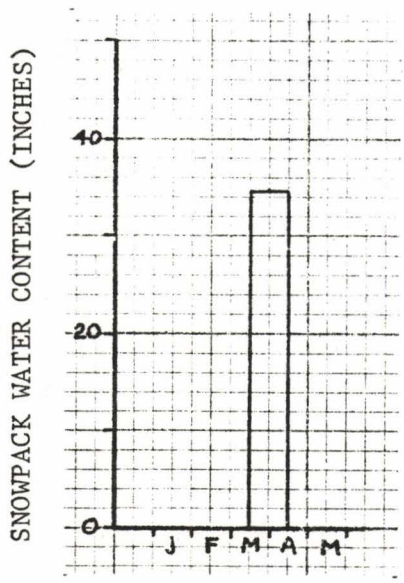
LOOKOUT
ELEV. = 5250

Figure 4



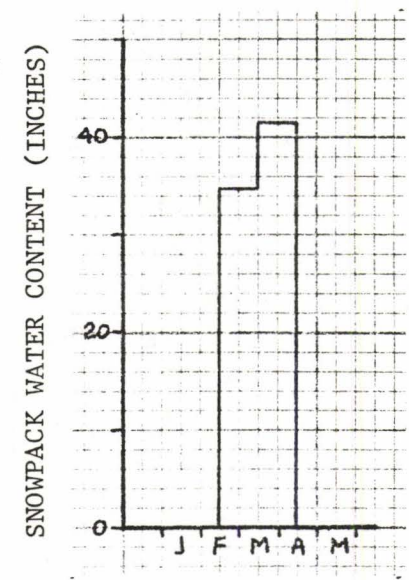
BELOW ROLAND
ELEV. = 3770

Figure 5



ABOVE ROLAND
ELEV. = 4350

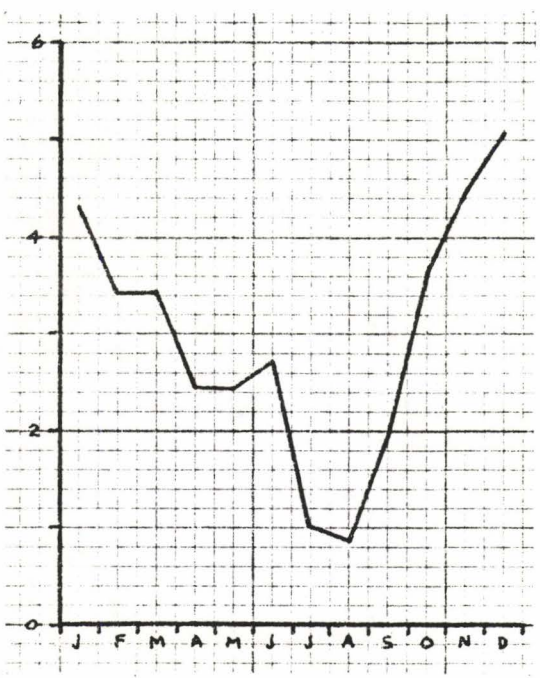
Figure 6



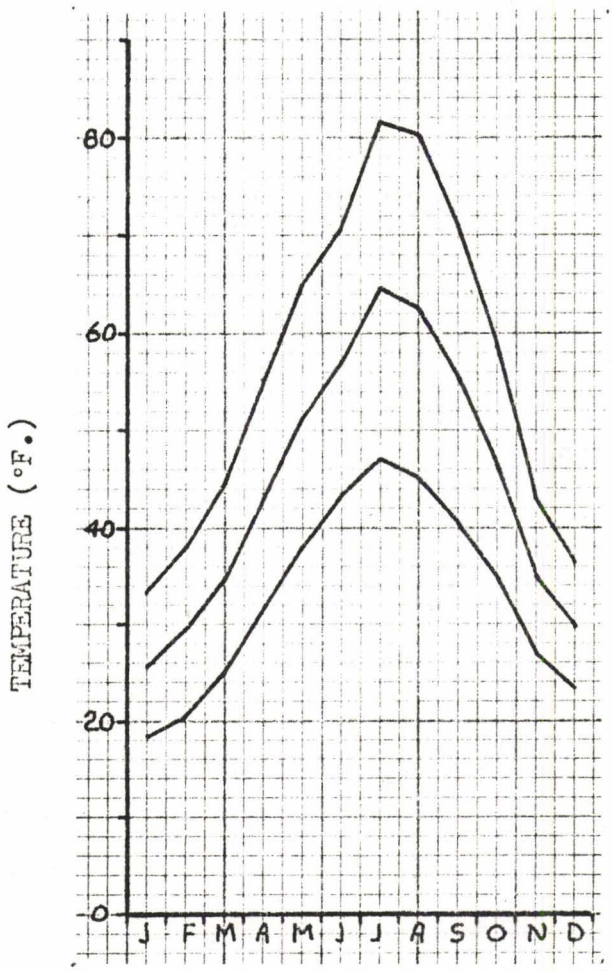
ROLAND SUMMIT
ELEV. = 5200

Figures 7, 8, and 9 show distribution of precipitation by months and mean maximum, minimum, and average temperatures for three stations again from west to east. Distributions of precipitation tends to support water content of snowpack data.

Figure 7

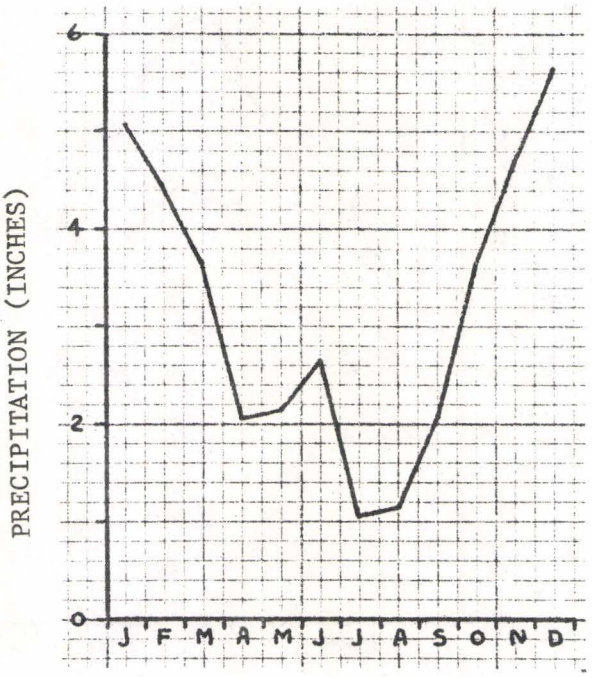


WALLACE WOODLAND PARK
ELEV. = 2935
YEARS = 30
A.A.P. = 35.75

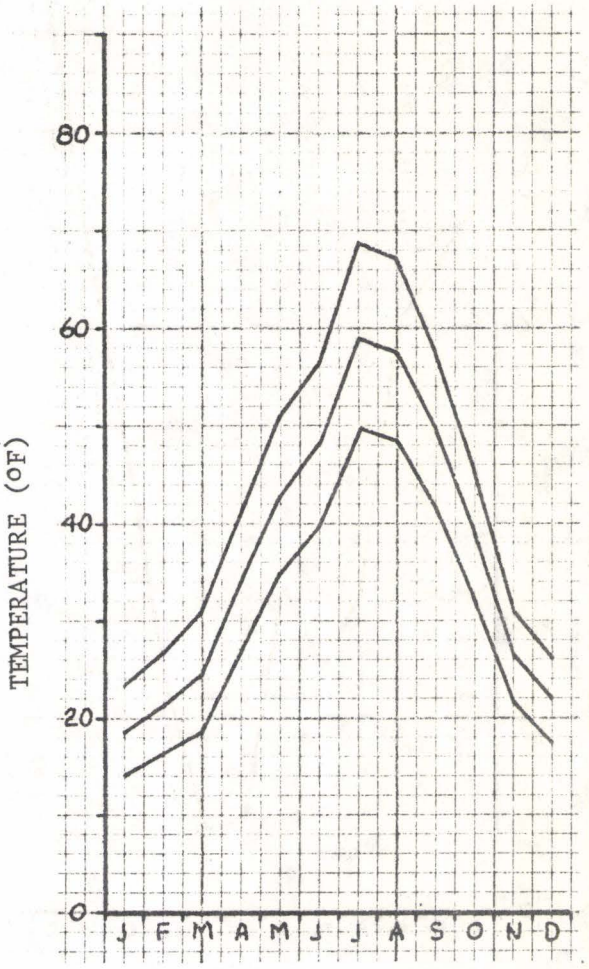


WALLACE WOODLAND PARK
ELEV. = 2935
YEARS = 30
56.5-44.7-32.9

Figure 8

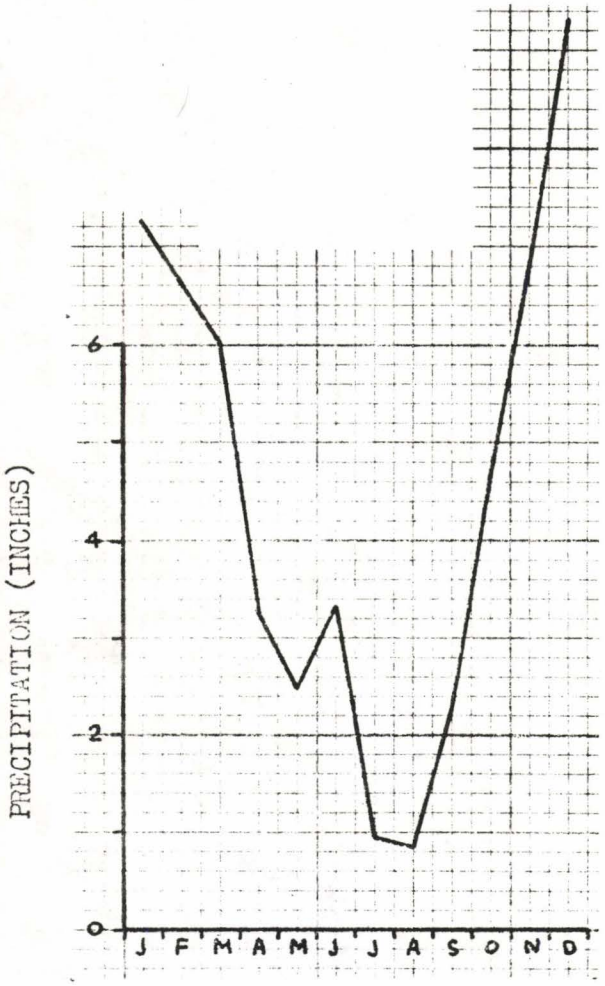


MULLAN PASS
ELEV. = 5963
YEARS = 19
A.A.P. = 38.23

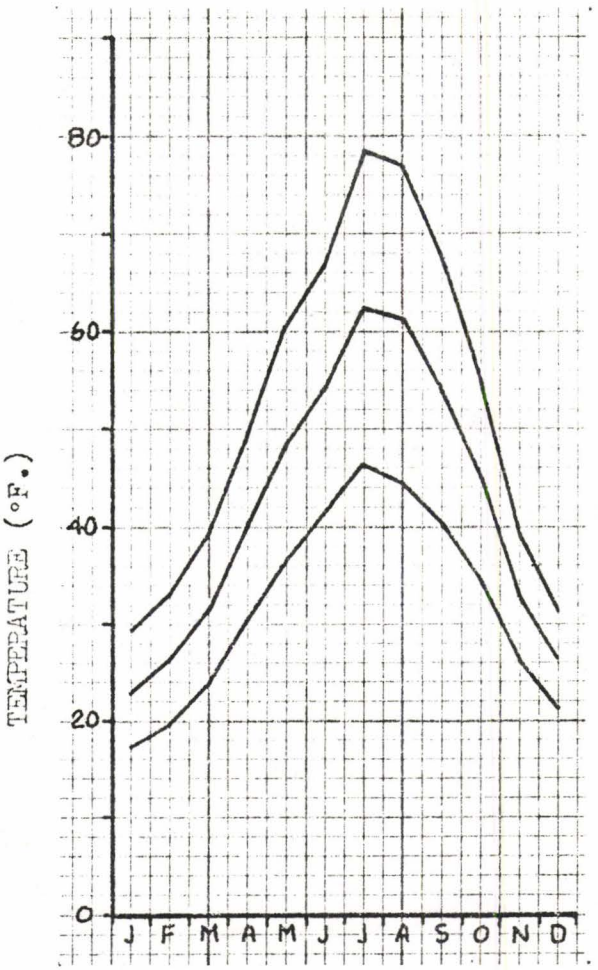


MULLAN PASS
ELEV. = 5963
YEARS = 18
43.8-37.0-30.2

Figure 9



ROLAND WEST PORTAL
ELEV. = 4150
YEARS = 22
A.A.P. = 53.75



ROLAND WEST PORTAL
ELEV. = 4150
YEARS = 20
52.4-42.1-31.9

Section VII - Open Northern Rockies Section

Only a small portion of this unit has been tentatively identified on the section and subsection map in the North Fork of the Salmon River drainage. The difficulties in dealing with this section will not be understood until the whole area has been worked out. There are two basic problems: (1) the problem of generalization - the area may be more properly recognized as a province rather than a section; (2) the several different kinds of mountains need to be recognized at the section level.

The portion of the section addressed here has been tentatively subdivided into four subsections as follows:

Map Symbol	Subsection Name	Range in Elevation	Dominant Local Relief	Median Elevation
1.	Hughes Point-Saddle Mt. Subsection	5000-8500	1500-2000	6000
2.	Gibbonsville Subsection	4100-8300	1500-2000	5500
3.	Salmon-Bitterroot Range Subsection	5000-10000	1500-2500	7600
4.	Salmon Lowlands Subsection	4000-6500	100/1000-1500	4700

Subsections 3 and 4 clearly have Open Northern Rocky lineal basin and range characteristics. Subsections 1 and 2 have characteristics more like those of the faulted and folded mountains to the northeast, but are probably transitional in nature. Here is a case when the boundary between sections may be thought of as being several miles wide.

The section and subsection map separates Subsections 1 and 2 primarily because the main ridge in Subsection 1 is about 1,000 feet higher elevation than the main ridge in Subsection 2. This difference results in the headlands in Subsection 1 having glaciated characteristics.

The geology of the section is dominantly Pre-Cambrian metasediments, which are mostly quartzites and phyllites. Between 10 to 15 percent of the area is volcanics (Challis), and less than 5 percent has granitic intrusions.

Douglas fir/pinegrass and subalpine fir/grouse whortleberry are the predominant types found on this section. Many habitat types characteristic of a more maritime climate are found in the northern part. These include Douglas fir/ninebark, Douglas fir/common snowberry and subalpine fir/beargrass. In the south part of the section, drier habitat types more characteristic of continental climate influence occur. These include the Douglas fir/arnica, Douglas fir/mountain snowberry and subalpine fir/elksedge.

Nontimbered, sagebrush-grass types infinger with the timber types throughout the area, but become more dominant to the south. The more important types include mountain big sagebrush/Idaho fescue, mountain big sagebrush/bluebunch wheatgrass, mountain big sagebrush/snowberry and subalpine big sagebrush/big mountain brome-Idaho fescue.

Average annual precipitation ranges from 10 to 20 inches and runoff 1 to 3 inches in Subsection 3, to 25 to 35 inches precipitation and 5 to 20 inches runoff in Subsection 1.

Typical lands found in Hughes Point-Saddle Mountain Subsection (VII-1).

Subsection 1 - Hughes Point-Saddle Mountain Subsection

The Hughes Point-Saddle Mountain Subsection is a small area (about 38,000 acres) lying between the Idaho-Montana border and the North Fork of the Salmon River. It is drained mainly by Ditch, Twin and the upper western reaches of the North Fork of the Salmon River. It ranges in elevation from about 5,000 to 8,500 feet.

Geology of over 85 percent of the area is in the Pre-Cambrian belts (chiefly quartzites and phyllites). Some granitics and volcanics do occur, however, in the southeastern portion of the area.

About 50 percent of this area is in Quartzite Fluvial Lands which in this case include the steeper slopes adjacent to the fault controlled North Fork of the Salmon. These lands extend up to elevations of about 7,000 feet. Ridges are sharp and valleys U-shaped. Slopes range dominantly from 50 to 70 percent. Soils are gravelly to stony, coarse to moderately coarse textured, but may be coarser textured on granitic parent material inclusions or finer textured on volcanic parent material inclusions. Douglas fir/ninebark, pinegrass, and tall huckleberry are the chief Douglas fir habitat types.

Water generally moves as subsurface flow, but overland flow can occur on the steeper slopes during peak periods.

About 25 percent of the area is in Quartzite Frost Churned (cryic) lands. These lands occur along ridgetops and high divides. They are generally at elevations greater than 7,000 feet. They are characterized by cold climate, short growing season, rounded ridges and gentle slopes (less than 50 percent). The dominant slope forming process has been frost action.

Soils are medium textured, gravelly and cobbly. They are generally well drained. Overland flow is rare. Soil temperatures are cold and productivity levels and revegetation potentials are lower than in the Quartzite Fluvial Lands. Most common habitat types are subalpine fir/whortleberry and Douglas fir/pinegrass.

Erosion hazards are very low to low with springs and seeps causing local problems. These lands are usually very stable road locations.

The other 25 percent of the area is in Quartzite Glaciated Lands. These lands often lie immediately adjacent to Strongly Glaciated Quartzite Lands and are dominated by the long, U-shaped valleys carved by the glacial "tongues" which crept down out of the high country. These troughs have steep (45 to 70 percent) sideslopes and broad, gently sloping valley bottoms. On the sideslopes soils are shallow to moderately deep, medium to coarse textured and cobbly. Erosion hazards are medium. Snowslide hazards are high.

The valley bottoms are generally more stable and well drained but the high runoff from the adjacent glaciated lands and heavy subsurface flow could lead to road washouts and other related problems due to interception of flow. These lands often support commercial stands of timber but the cold climate limits revegetation success. Care must be taken not to disturb large amounts of vegetation in these troughs.

In the Allan Mountain area, there are cirques, steep rocky ridges and the upper portions of the glacial troughs. Slopes are long and steep. Soil mantles are thin. Timber productivity is low.

The Douglas fir/pinegrass and the subalpine fir/grouse whortleberry are the predominant timber types in this subsection. Also found are the ponderosa pine/common snowberry, Douglas fir/ninebark, Douglas fir/common snowberry, and the subalpine fir/beargrass.

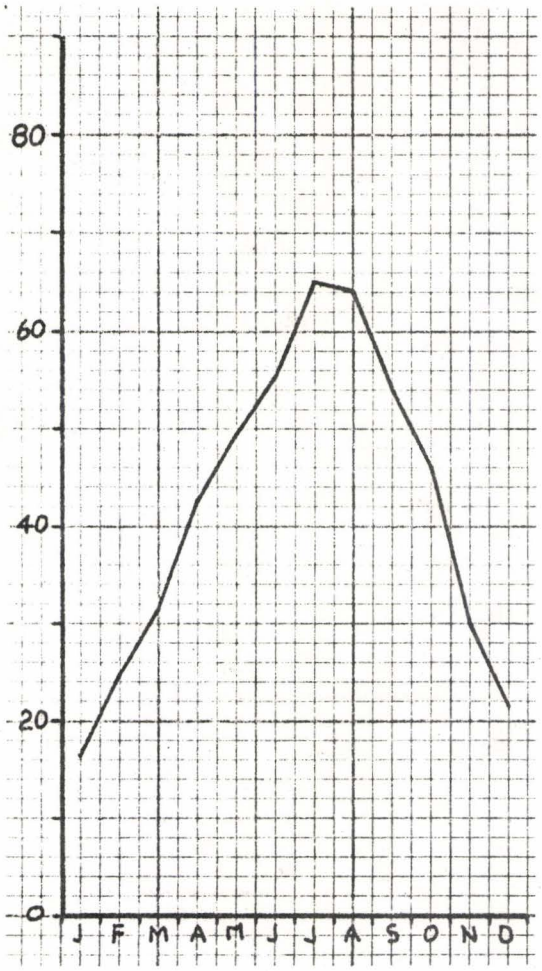
Nontimbered areas are dominated by mountain big sagebrush/bluebunch wheatgrass, mountain big sagebrush/Idaho fescue, and mountain big sagebrush/snowberry.

Average annual precipitation ranges from 25 to 35 inches and runoff from 5 to 20 inches. Figure 1 shows the ranges in precipitation that can be expected from 6- and 24-hour storms from selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.4-1.6
10	24	2.0-2.6
25	24	2.2-3.0
10	6	1.2-1.3
25	6	1.5-1.6

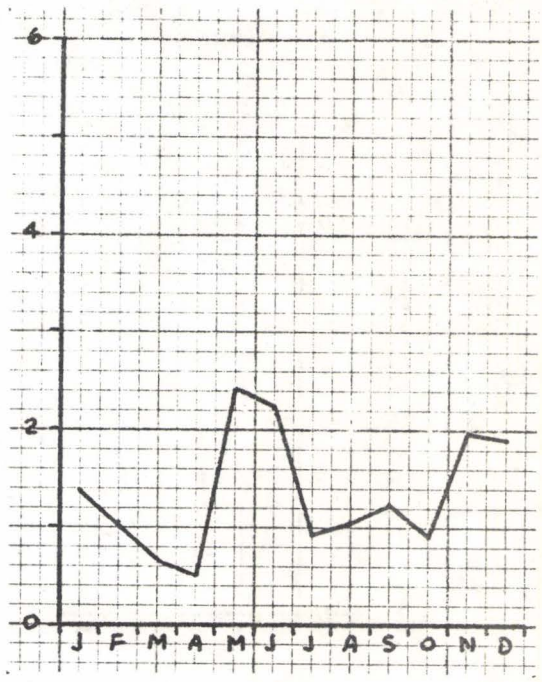
Figures 2 and 3 show the average mean temperature and mostly distribution of precipitation respectively for the weather station at Gibbonsville. Figures 4 and 5 show the snowpack water content for Moose Creek and Gibbons Pass.

Figure 2



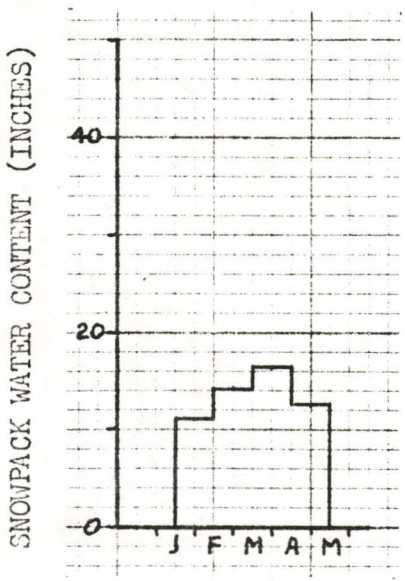
GIBBONSVILLE
ELEV. = 4500
YEARS = 6
-41.8-

Figure 3



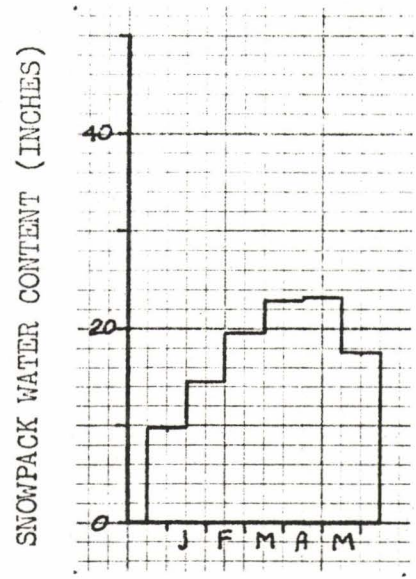
GIBBONSVILLE
ELEV. = 4500
YEARS = 6
A.A.P. = 16.27

Figure 4



MOOSE CREEK
ELEV. = 6200

Figure 5



GIBBONS PASS
ELEV. = 7100

Typical view of lands in Gibbonsville Subsection (VII-2).

Subsection 2 - Gibbonsville Subsection

The Gibbonsville Subsection is a small area (about 50,000 acres) lying between the Continental Divide and the North Fork of the Salmon River. Elevation ranges from about 5,000 to 7,000 feet. It is drained mainly by Sheep, Lick, Dahloneys, Anderson, and Pierce Creeks.

Geology in the area is mostly quartzites and phyllites of the Pre-Cambrian Belt Super Group. About 65 percent of this area is in the Quartzite Fluvial Lands Landtype association which in this case includes the steeper slope adjacent to the fault controlled North Fork of the Salmon. These lands extend up to elevations of about 7,000 feet. Ridges are sharp and valleys U-shaped. Slopes range dominantly from 50 to 70 percent. Soils are gravelly to stony, coarse to moderately coarse textured, but may be coarser textured on granitic parent material inclusions or finer textured on volcanic parent material inclusions. Douglas fir/ninebark, pinegrass, and tall huckleberry are the chief Douglas fir habitat types.

Water generally moves as subsurface flow, but overland flow can occur on the steeper slopes during peak periods.

About 35 percent of the area is in Quartzite Glaciated Lands. These lands often lie immediately adjacent to Strongly Glaciated Quartzite Lands and are dominated by the long, U-shaped valleys carved by the glacial "tongues" which crept down out of the high country. These troughs have steep (45 to 70 percent) sideslopes and broad, gently sloping valley bottoms. On the sideslopes soils are shallow to moderately deep, medium to coarse textured and cobbly. Erosion hazards are medium. Snowslide hazards are high.

The valley bottoms are generally more stable and well drained but the high runoff from the adjacent glaciated lands and heavy subsurface flow could lead to road washouts and other related problems due to interception of flow. These lands often support commercial stands of timber but the cold climate limits revegetation success. Care must be taken not to disturb large amounts of vegetation in these troughs.

These lands are typically alpine glaciated lands and occur in the Lemhi Range and the Beaverhead Range. They are comprised of cirques, cirque lakes, steep rocky ridges and the upper portion of the glacial trough. Slopes are long and steep.

Soil mantles are thin or nonexistent. Timber productivity is low.

The Douglas fir/pinegrass and the subalpine fir/grouse whortleberry are the predominant timber types on this subsection. Also found are the ponderosa pine/common snowberry and the subalpine fir/beargrass.

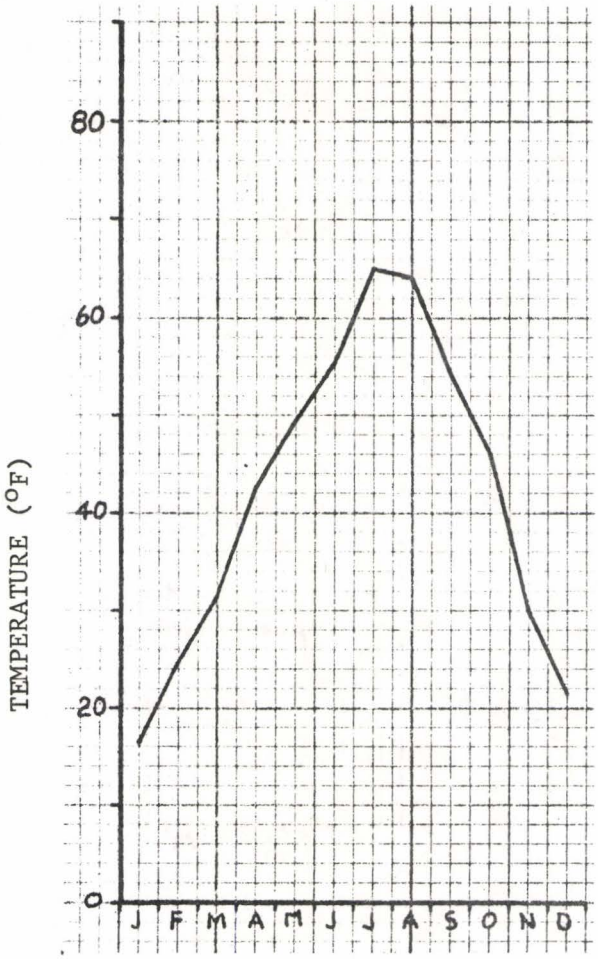
Nontimbered areas are dominated by mountain big sagebrush/bluebunch wheatgrass and mountain big sagebrush/Idaho fescue.

Average annual precipitation ranges from 20 to 30 inches with runoff from 5 to 20 inches. Figure 1 shows the ranges in precipitation which can be expected for 6- and 24-hour storms at selected expected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.4-1.6
10	24	2.0-2.2
25	24	2.2-2.6
10	6	1.2-1.3
25	6	1.5

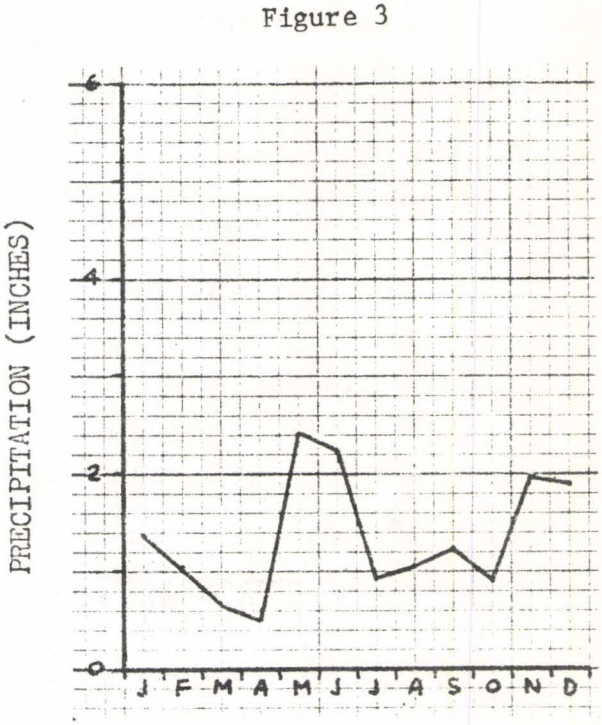
Figures 2, 3, 4, and 5 of the preceding subsection give climatic and water content of snowpack information from adjacent stations.

Figure 2



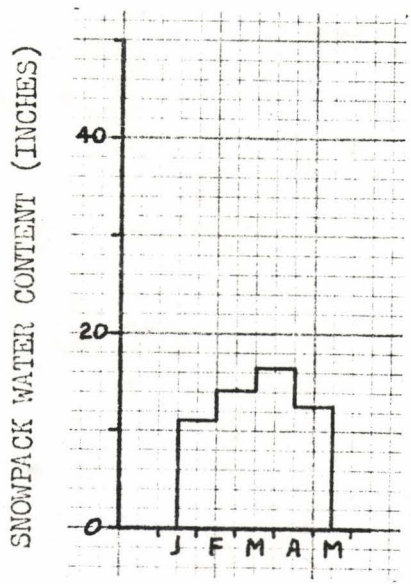
GIBBONSVILLE
ELEV. = 4500
YEARS = 6
-41.8-

Figure 3



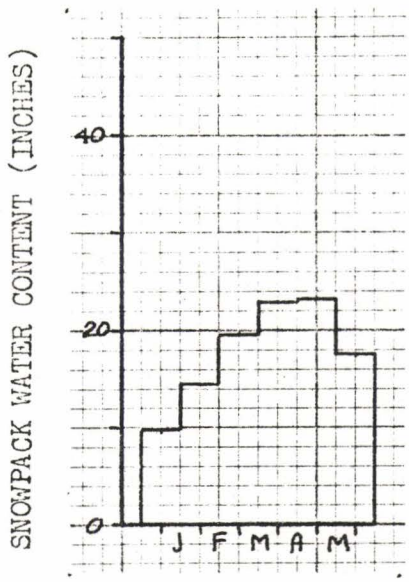
GIBBONSVILLE
ELEV. = 4500
YEARS = 6
A.A.P. = 16.27

Figure 4



MOOSE CREEK
ELEV. = 6200

Figure 5



GIBBONS PASS
ELEV. = 7100

Subsection 3 - Salmon-Bitterroot Range Subsection

The Salmon-Bitterroot Range Subsection is made up chiefly of high structural chiefly quartzite ridges and west slopes which, in this area, constitute the Continental Divide and the boundary between Idaho and Montana. Only a portion of the area is shown on the map and described briefly here. Elevations range from about 5,000 to almost 10,000 feet.

About 40 percent of the area on the map is in the Strongly Glaciated Landtype association with strongly expressed cirque headlands and mostly scoured steep glacial troughs. Anderson recognized several periods of glaciation. A portion of the highest elevation is above timberline with alpine turf plant communities. Immediately below is the whitebark pine/subalpine fir zone. The rest of this portion of the area is chiefly in the subalpine fir habitat types.

Except for small areas of Quartzite Frost Churned (cryic) Lands, the rest of the area shown on the map is in Quartzite Fluvial Lands. These lands occur at elevations between 5,000 and 7,000 feet. The primary slope forming process has been the movement of water downslope. The ridges are sharp and the valleys are V-shaped. Slopes are generally from 45 percent to 70 percent. The soils are medium to coarse textured, gravelly sandy loams and gravelly loams. The erosion hazards are low to moderate. Roads built on these soils are stable, requiring low maintenance, and can be used year around. Douglas fir is the primary tree species with some intermixing of ponderosa pine. The primary habitat types seem to be Douglas fir/pinegrass and Douglas fir/ninebark. Water generally moves downslope via subsurface flow but overland flow can occur on steep slopes during peak periods.

The Douglas fir/pinegrass is the predominant timber type on this subsection with some Douglas fir/ninebark. Pockets of Douglas fir/elksedge and Douglas fir/common snowberry are also found on suitable sites. To the south in this subsection, drier Douglas fir habitat types tend to dominate such as the Douglas fir/arnica, Douglas fir/mountain snowberry and Douglas fir/elksedge.

Subalpine fir/elksedge and subalpine fir/grouse whortleberry are the dominant types in the subalpine fir zone in the northern part of this subsection, with some pockets of subalpine fir/beargrass. To the south the subalpine fir/elksedge is dominant and this type grades into the whitebark pine barren zone.

Nontimbered areas are dominated by mountain big sagebrush/bluebunch wheatgrass, mountain big sagebrush/Idaho fescue, mountain big sagebrush/mountain snowberry, and subalpine big sagebrush/big mountain brome/Idaho fescue. These sagebrush-grass types become more common in the southern part of the subsection.

Average annual precipitation ranges from 15 to 30 inches with runoff from 5 to 20 inches. The following shows the range in precipitation which may be expected from 6- and 24-hour storms from selected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.2-2.8	
10	24	1.6-2.8	
25	24	2.0-3.0	3.2
10	6	1.1-1.5	
25	6	1.6-1.8	

A view of Salmon River Lowlands Subsection (VII-4) middleground with Salmon-Bitterroot Range (VII-3) in background.

Subsection 4 - Salmon Lowlands Subsection

The Salmon Lowlands Subsection contains the Salmon Basin and the terrace covered foothills of the Beaverhead-Bitterroot Range on the east and the Salmon River Mountains to the west. Elevations range from about 4,000 to 6,000 feet.

Anderson describes the basin as follows:

> The Salmon Basin is the largest and most obvious structural feature in the area. This basin in which the Carmen formation has accumulated has every aspect of a basin produced by downwarping. Not only do the Carmen beds dip inward toward the center, but the older rocks around the rim of the basin also dip toward and then pass under the basin. This relationship of the older rocks is particularly noticeable in the case of the Challis volcanics. Even the ridges forming the eastern slope of the Salmon River Mountains slope downward in such a way as to suggest that they too are involved in the downwarp and that the mountain slope passes under and forms the under floor of the basin.
>
> Whatever part faulting may have had in the development of the basin has been effaced by the fill of sedimentary materials. There appears to be no encircling faults at the margin of the basin and thus no evidence that subsidence might have accompanied faulting. It is anticipated, however, that earlier zones of structural weakness may have had something to do with controlling the location and shape of the basin.

Two ages of glaciation in the section are represented by terrace deposits below 7,000 feet in the subsection. These, according to Anderson, are Pre-Wisconsin.

The basin portion geology is chiefly Challis volcanics (higher) and Carmen sediments (lower).

The entire subsection contains almost no forest habitat types and is almost entirely outside National Forest boundaries.

Round Valley Subsection.

Section VIII - Wallowa-Seven Devils Section (Idaho portion)

The Idaho portion of this section is in the Columbia Intermontane Province.* It is addressed in this report because it is adjacent to the Batholith portion of the Northern Rocky Mountain Province and contains portions of National Forests which are within the Idaho Batholith. The Wallowa-Seven Devils Section also has some granitic intrusions related to the Idaho Batholith. Charles B. Hunt included the Seven Devils portion within the Northern Rocky Mountain Province rather than with the Columbia Intermontane Province. Subsections 4 and 5 are not treated here because they contain little or no National Forest land.

In Idaho, this section extends north from Boise to Lucille. It is largely bounded on the south by the Malheur-Boise-Kinghill Section, on the west by the Hells Canyon Subsection, on the north by the Tri-State Uplands Section, and on the east by Northern Rocky Mountain Province.

The most extensive rock type is the Columbia River basalts. Older rocks include outliers and intrusions of Idaho Batholith granitics and (in the Seven Devils and Sturgil Peak Subsections) metamorphic volcanics, sediments, and intrusive rocks. Younger rocks include sediments of the Payette and Idaho formations in the Boise and Emmett areas.

Elevations range from less than 2,000 feet in Hells Canyon to over 9,000 feet in the Seven Devils.

This section exhibits floristic characteristics foreign to the rest of Idaho. Except for a few species in the Hells Canyon area, however, the vegetation shows little evidence of a refuge for relict, or endemic communities. Perhaps this area represents a three-part transition between the vegetal units of central Idaho, northern Idaho, and east-central Oregon. Vegetal similarities to all three are apparent, but their occurrence is somewhat chaotic, especially in the Hornet Plateau Subsection. The closest vegetal relationship, if any, is perhaps best ascribed to eastern Oregon as the section boundary indicates.

Forested areas in this section are mainly grand fir or Douglas fir climax. Spiraea, tall huckleberry, common snowberry, and ninebark are the primary understory dominants. The ponderosa pine zone is notably scarce in many areas, a feature that becomes increasingly apparent eastward. When found, climax ponderosa pine usually dominates a common snowberry or bluebunch wheatgrass understory. The latter habitat type often occurs on basalt outcrops with shallow soil. Basalt scablands occur throughout much of the area. These sites are often dominated by eriogonum communities, a feature common to eastern Oregon and Washington. Deeper soils between the scabby areas may

*After Freeman, Forester, and Lupher, 1945.

support mountain shrub communities similar to those along the Boise Front Range. The deeper soils may also support steppe vegetation resembling that of the Palouse Prairie or the central Idaho foothills. Subalpine series are dominant at the higher elevations of the Seven Devils Subsection.

Average annual precipitation ranges from less than 15 inches to over 45 inches with runoff ranging from 1 to 30 inches. Excluding the Seven Devils, the precipitation ranges from less than 15 inches to 40 inches and the runoff 1 to 20 inches.

Table 14 identifies the subsections containing National Forest lands.

Table 14

Map Symbol	Subsection Name and Brief Description	Range in Elevation	Dominant Local Relief	Median Elevation
1.	Round Valley Subsection - a faulted upland complex with mainly granitic and basalt bedrock.	3200-8300	1200-2000	N 1/2-5500 S 1/2-4500
2.	Council Mt. Subsection - a sloping block faulted upland of dominantly basalt bedrock with granitic intrusions.	3200-8100	2000-3000	5000
3.	Sturgil Peak Subsection - a moderately to steeply sloping dissected uplifted plateau with mostly volcanic bedrock (both miocene and Permian-Triassic) with some granitic intrusions.	3000-7900	Foothills 600-1000 Uplands 1000-1500	SW 1/2-4500 NW 1/2-5500
4.	Hornet Plateau Subsection - a gently sloping dissected Columbia River basalt plateau.	4000-6500	Foothills 100-500 Uplands 1000-1500	4800
7.	Hells Canyon Subsection - a deeply entrenched canyon mainly in basalts & Permian-Triassic-volcanics & metasediments.	1600-7000	3800-5000	3500
8.	Seven Devils Subsection - a steep uplifted mountain range chiefly of Permian-Triassics & a few remnant basalt caps & border zone rocks.	2200-9400	2000-3000	6000

Subsection 1 - Round Valley Subsection

The Round Valley Subsection is an area of about 260,000 acres in the gently westward tilted, weakly to moderately dissected uplands located from just west of the southern tip of Cascade Reservoir south to Gardenia and east from Squaw Creek to the ridge above the Main and North Forks of the Payette River. It ranges in elevation from about 3,500 feet to 8,000 feet. Dominant relief in the upland portion is about 1,200 feet and in the major drainages about 2,000 feet.

Bedrock in the area is chiefly granitic (mostly quartz monzonite). Except for the glaciated lands, these rocks are dominantly in weathering classes 4 to 6. Columbia River basalts occupy the lower eastern slopes and some scattered upland areas.

The following table shows the approximate composition of the area by landtype associations:

Landtype Association	Approx. Proportion	Dominating Habitat Type
Strongly Glaciated Lands (Headlands & Trough Lands)	5%	
Frost Churned (cryic) Uplands	5%	
Fluvial Granitic Lands	30%	
Mature Relief Fluvial Lands	20%	
Structurally Controlled Granite Fluvial Lands	10%	
Structurally Controlled Basalt Lands	25%	
Depositional Lands	5%	

Soils in the Strongly Glaciated Lands Association are characterized by shallow depths (less than 10 inches), lack of horizon development, sandy textures, high inherent erosion hazards and low fertility. The soils on the Cirque Basin Lands, however, are deeper (more than 30 inches to bedrock), have sandy loam textures, well expressed horizons, are relatively fertile and low to moderate erosion hazards.

The headlands are important as water producers and return as streamflow up to 70 percent of the moisture received. Surface runoff and avalanche potential is high on the steep landtypes in the association. Cirque basins, containing small lakes, act as reservoirs and are a highly effective buffer between the steep rocky headlands and adjacent depositional lands. Sediment production is high from the steep rocky landtypes

and accumulates in drainageways of lower lying lands. Disturbance of these downstream aluvial channels during high runoff periods causes high sediment yields. In some cases, dissection of mountain slopes can be traced to the runoff from higher lying rocky lands.

Herbage and timber production is generally low due to the sparse cover and limiting climatic and soil factors. Whitebark pine, subalpine fir and high elevation grass and brush vegetative types dominate this area. Exceptions to this are localized wet areas in cirque basins which have a moderate to high productive capacity. Adverse soil and climatic factors limit the revegetation potential of these lands.

These lands have a high scenic and recreational value and produce moderate amounts of grass and brush type forage. Many of the cirque lakes and streams provide habitat for fisheries. The heavy rapid runoff is a major management consideration.

Glaciated Granitic Trough Lands are composed of lands that have been carved and shaped by moving glaciers, resulting in U-shaped valleys with steep sideslopes and gently sloping alluvial valley train lands in the valley bottoms. These lands are usually adjacent to and below the high peaks, rocky ridges, and cirque basins in the Glaciated Granitic Headland Landtype association. Elevations range from 6,000 to 8,000 feet. The underlying granitic bedrock is variable, ranging from slightly to well weathered and well fractured or masked.

Soils in this landtype association are characterized by sandy or loamy textures with more than 35 percent rock fragments. Depths vary from shallow to deep and are generally related to the amount of slope dissection and scouring action of the glacier. Lack of horizon development and low fertility levels are characteristic of the shallow soils. Inherent erosion hazard is moderate to high on the sideslopes and low on the alluvial valley train land.

These lands are important as water producers and return as streamflow much of the moisture received. Most of the runoff is by shallow and moderately deep subsurface flow, except on strongly dissected areas with shallow soils where water leaves as surface flow. The valley train lands in the bottoms of the troughs act as regulators for the water by receiving it from the above slopes and discharging it to streams in a sustained flow. Avalanche hazards on the sideslopes are high.

Herbage and timber productivity are generally low to moderate with the dominant limitations for revegetation and growth being cold climate and, in some landtypes, shallow coarse-textured soils. Subalpine fir and high elevation grass-brush habitat types dominate these areas.

Frost Churned (cryic) Granitic Uplands - These lands are located adjacent to and are sometime intermingled with glaciated lands. The effects of ice and permanent snowfield action were mainly localized on these lands. Soil and rock materials were not carried away by major ice currents, nor was the bedrock deeply stripped. The bedrock is, therefore, more weathered and less fractured than in the glaciated lands. This association includes Cryoplanated Upland and Cryoplanated Basin Landtypes. Slopes are gentle to moderately steep (less than 50 percent gradients), and undulating topography is common. Elevations range from 6,000 to 8,000 feet.

Soils are dominantly moderately deep and deep skeletal sandy or loamy textures. Surface layers commonly have sand fractions which are high in the fine and medium sizes and high silt contents. Inherent erosion is low to moderate. These lands have high infiltration and percolation rates and almost all the precipitation that falls becomes subsurface moisture. The well-weathered bedrock becomes relatively impermeable with depth, and excess moisture is yielded as subsurface flow. The deep soils and well-weathered bedrock act as a storage reservoir. High amounts of precipitation are received on these lands and much of this is returned to streams as sustained flow. Sediment rates are low unless the vegetation and/or surface soil is disturbed. The vegetative cover on these lands varies from open brush-grass communities to dense stands of subalpine fir habitat types. At lower elevations Douglas fir habitat types are common. Herbage and timber productivity and revegetation potential is low to moderate and is restricted primarily by cold climate.

Fluvial Lands - These mountainous lands have been shaped primarily by the action of water or stream cutting. The six landtype associations making up these landtypes are (1) Fluvial Granitic Lands, (2) Mature Relief Fluvial Lands, (3) Structurally Controlled Granitic Fluvial Lands, (4) Strongly Dissected Granitic Fluvial Lands, (5) Steep Granitic Canyon Slopes, and (6) Xeric Granitic Fluvial Lands.

Fluvial Granitic Lands are mountain slope lands that have been formed primarily by fluvial or stream cutting action. Slopes are steep (commonly over 60 percent) and have strongly expressed, V-shaped drainageways that dissect the slope at moderate to wide intervals. The underlying quartz-monzonite or granitic type bedrock is moderately well to well weathered and fracturing is often masked. The bedrock commonly tends to spall when exposed to the atmosphere. These lands usually occur at elevations less than 6,000 feet. Soils are quite variable as to depth, but generally have sandy or loamy textures which may or may not be skeletal (more than 35 percent coarse fragments). For the most part, the soils in these lands have little profile development other than dark colored "A" horizons and have moderately low or low fertility levels. Erosion hazards range from low on the low gradient loamy soils to high on the steep, coarse-textured sandy soils.

Infiltration and percolation rates are generally high and a good portion of the moisture that falls leaves as moderately deep and deep subsurface water. The steep slopes with sandy soils are very fragile and disturbance of the soils or removal of vegetative cover will accelerate the sediment production. Vegetative cover ranges from open grass-brush on droughty south-facing slopes to dense stands of Douglas fir and ponderosa pine habitat types. Herbage productivity and revegetation potentials are low to high, and timber productivity and revegetation potentials are low to moderate. Principle limitations are droughty soils, vegetative competition, high evapotranspiration ratios, and high erosion and sedimentation rates. These lands are valuable for the production of wood, forage and water. The fine fraction of surface soils may result in dust problems on disturbed areas. Roads located on the upper one-third of the slope will reduce the possibility of intercepting subsurface water.

Mature Relief Fluvial Lands are moderately steep to steep mountain slopes with well rounded ridge tops and drainageways. The stream cutting or fluvial process acting on areas of well weathered granitic bedrock has resulted in the rounded appearance and the finely meshed dendritic pattern of the drainageways characteristic of these lands. This landtype association is found on structurally altered landscapes at elevations under 6,000 feet.

Soils are variable as to depth but generally have sandy or coarse loamy textures. Because normal soil removal is low on these lands, the soils have more well defined horizons than the soils on other fluvial lands. Surface erosion hazard is low to moderate for most of the slopes but is high on the steep slopes with sandy soils. Infiltration and percolation rates are generally high for the soil mantle, but the well weathered bedrock restricts further downward movement of water. Therefore, most of the excess water that falls on the slope leaves as moderately deep subsurface water. Poor gradation of materials in the soil and underlying weathered bedrock result in a fragile, erosive slope. Concentration of water or change to surface runoff will greatly increase the sediment production from these slopes. Vegetative cover ranges from open grass-brush on droughty south-facing slopes to dense stands of Douglas fir and ponderosa pine habitat types on the moist sites. Revegetation and productivity potentials for herbage and timber production are moderate to high. These lands are used primarily for timber production and grazing. Activities that remove the vegetative cover, disturb the surface soil, or change the hydrologic function tend to greatly accelerate the surface erosion or sediment yield of these slopes.

Structurally Controlled Granitic Fluvial Lands are mountain lands that have been altered by faulting action. Upon faulting these lands exhibited a bench or basinlike appearance. In some cases subsequent fluvial or stream cutting action has incised the lands with moderately deep and deep drainageways. The resulting topography of ridge tops with a common

base level and steep sideslopes in the drainageways is characteristic. Soils range from shallow to deep and generally have coarse loamy or loamy skeletal (more than 35 percent coarse fragments) textures. Little profile development occurs in the soils on the sideslopes, but those on the more level ridge tops or areas exhibit moderate horizon development. The underlying bedrock is generally well weathered with marked fracturing and spalls upon exposure to the atmosphere. Infiltration and percolation rates are high; but due to the shallow depth of soils over bedrock on the sideslopes, excess water leaves as shallow subsurface flow. Erosion hazards are low on the ridge tops, but disturbance on the sideslopes tends to greatly increase the hazard of sediment production from both surface erosion and mass failures. Vegetation is dominantly ponderosa pine and Douglas fir habitat types. Revegetation potential is low to moderate and is restricted primarily by soils with low water-holding capacity. Timber productivity potential is moderate to high.

The erosion hazard on these lands is generally low to moderate with the exception of the steep fragile sideslopes in drainageways on which it is high. Safe access across the drainageways is often the limiting factor to development of these lands.

Structurally Controlled Basalt Lands are the result of volcanic flows that have subsequently been uplifted and tilted. The resulting topography is one that has a moderate slope dipping toward the southwest and steep, short escarpments sloping to the northeast. The lands have various degrees of dissection as a result of more recent fluvial actions. The west-facing dip slopes have gradients of 30 to 50 percent, and the escarpments are somewhat steeper, ranging up to 65 percent. Elevations range from 4,000 to 6,500 feet. Soils are dominantly shallow and moderately deep but generally have a clay loam subsoil. These soils have more strongly expressed horizon development than those formed on granitic materials. Fertility is moderate, and erosion hazards are moderately low to high. The underlying basaltic bedrock is quite variable as to weathering, hardness, and fracturing. Overland flow is infrequent and confined to steeper slopes and scabland areas. Subsurface flow and deep seepage are the dominant means of excess water removal. Infiltration and percolation rates are moderate to moderately slow. The vegetative cover on these lands varies from open-grass communities to Douglas fir/ninebark and Douglas fir/elksedge habitat types. Herbage productive potential is low to moderate. Timber productivity is moderate where applicable. Limitations for reforestations range from slight to severe. Dominant limitations are adverse climate, vegetative competition, and high evapotranspiration ratios. These lands are valuable for the production of timber, forage, and seasonal water yields. The finer textured soils will have poor trafficability when wet.

Depositional Lands (no description).

Inclusions of Xerix Granitic Fluvial Lands.

Subalpine big sagebrush/bluebunch wheatgrass and subalpine big sagebrush/Idaho fescue occupy the warm, dry extremes of this subsection. This situation merges with a narrow ponderosa pine zone composed mainly of ponderosa pine/common snowberry on deep fertile soils and ponderosa pine/mountain snowberry-chokecherry phase on thin rocky soils. Within this general area are lesser inclusions of mountain shrub communities composed mainly of chokecherry, bittercherry, mountain snowberry, bitterbrush and subalpine big sagebrush.

Douglas fir/common snowberry and Douglas fir/ninebark are often extensive habitat types on southerly and northerly aspects respectively. Douglas fir/pinegrass may occur in small amounts on upper slopes and ridges of the same area and at higher elevations. The grand fir zone becomes increasingly common toward the northern end of this unit. Grand fir/tall huckleberry is quite common on the northerly aspects at midelevations. Grand fir/spiraea often occurs on warmer aspects in the same area.

Along the eastern border are a few areas with enough elevation to support subalpine fir. Here alpine fir/tall huckleberry is the most common habitat type on northerly aspects. Mostly Douglas fir/pinegrass and grand fir/spiraea are found on adjacent south slopes. Some western whitebark pine/alpine fir exists along the highest ridges of the eastern border of this subsection.

Average annual precipitation ranges from about 25 to 45 inches with runoff from about 10 to 20 inches. The following shows the ranges in precipitation which can be expected for 6- and 24-hour storms of selected expected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.6-2.2	
10	24	2.6-3.0	2.4
25	24	2.6-3.6	
10	6	1.3-1.7	
25	6	1.6-2.0	

Council Mountain Subsection (2); Long Valley Foothills Subsection in background (18).

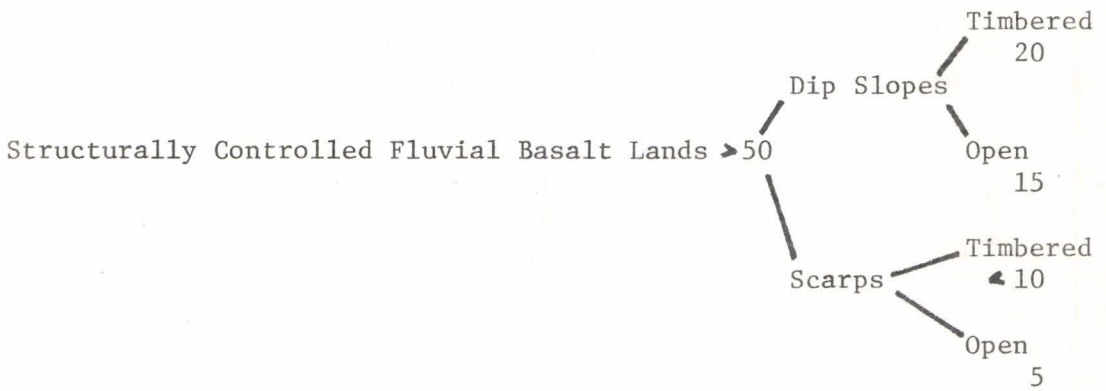
Subsection 2 - Council Mt. Subsection

The Council Mt. Subsection is about 200,000 acres comprising the eastern headwaters of the Weiser River. It ranges in elevation from about 4,000 feet to over 8,000 feet at Council Mountain. Dominant relief of the uplands is about 2,000 feet and on the main drainages about 3,000 feet.

The bedrock consists dominantly of westward tilted blocks of Columbia River basalts with a west central core of granitics (granodiorite, quartz diorite, and migmatite). This core constitutes about 20 percent of the area.

The following table gives the approximate proportions of the dominant landtype associations in the subsection:

Landtype Association	Approximate Proportion (%)
Strongly Glaciated Lands	5
Frost Churned (cryic) Granitic Uplands	10
Frost Churned (cryic) Basaltic Uplands	35



Minor amounts of Fluvial Granitic Land are also present in the central portion of the area.

Frost Churned (cryic) Granitic Uplands are located adjacent to and are sometimes intermingled with glaciated lands. The effects of ice and permanent snow field action were mainly localized on these lands. Soil and rock materials were not carried away by major ice currents nor was the bedrock deeply stripped. The bedrock is, therefore, more weathered and less fractured than in the glaciated lands. This association includes Cryoplanated Upland and Cryoplanated Basin Landtypes. Slopes are gentle to moderately steep (less than 50 percent gradients), and undulating topography is common. Elevations range from 6,000 to 8,000 feet.

Soils are dominantly moderately deep and deep skeletal sandy or loamy textures. Surface layers commonly have sand fractions which are high in the fine and medium sizes and have high silt contents. Inherent erosion is low to moderate.

These lands have high infiltration and percolation rates and almost all the precipitation that falls becomes subsurface moisture. The well weathered bedrock becomes relatively impermeable with depth, and excess moisture is yielded as subsurface flow. The deep soils and well weathered bedrock act as a storage reservoir. High amounts of precipitation are received on these lands and much of this is returned to streams as sustained flow. Sediment rates are low unless the vegetation and/or surface soil is disturbed.

The vegetative cover on these lands varies from open brush-grass communities to dense stands of subalpine fir habitat types. At lower elevations Douglas fir habitat types are common. Herbage and timber productivity and revegetation potential is low to moderate and is restricted primarily by cold climate.

These lands are valuable for the production of some wood products, forage, and water. The fine fraction of surface soils may result in dust problems on disturbed areas. Roads located on the upper one-third of the slope will reduce the possibility of intercepting subsurface water.

Frost Churned (cryic) Basalt Lands are similar to their granitic counterparts except that the soils are loamy to fine loamy and have more coarse fragments.

Fluvial Granitic Lands are mountain slope lands that have been formed primarily by fluvial or stream cutting action. The underlying quartz-monzonite or granitic type bedrock is moderately well to well weathered and fracturing is often masked. The bedrock commonly tends to spall when exposed to the atmosphere. These lands usually occur at elevations less than 6,000 feet.

Soils are quite variable as to depth, but generally have sandy or loamy textures which may or may not be skeletal (more than 35 percent coarse fragments). For the most part, the soils in these lands have little profile development other than dark colored "A" horizons and have moderately low or low gradient levels. Erosion hazards range from low on the low gradient loamy soils to high on the steep, coarse-textured sandy soils.

Infiltration and percolation rates are generally high and a good portion of the moisture that falls leaves as moderately deep and deep subsurface water. The steep slopes with sandy soils are very fragile and disturbance of the soils or removal of vegetative cover will accelerate the sediment production.

Vegetative cover ranges from open grass-brush on droughty south-facing slopes to dense stands of Douglas fir and ponderosa pine habitat types. Herbage productivity and revegetation potentials are low to high, and timber productivity and revegetation potentials are low to moderate. Principle limitations are droughty soils, vegetative competition and high evapotranspiration ratios.

These lands are valuable for the production of wood, forage and water. The fine fraction of surface soils may result in dust problems on disturbed areas. Roads located on the upper one-third of the slope will reduce the possibility of intercepting subsurface water.

Structurally Controlled Basalt Lands are the result of volcanic flows that have subsequently been uplifted and faulted. The resulting topography is one that has a moderate slope dipping toward the west and steep, short escarpments sloping to the east. The lands have various degrees of dissection as a result of more recent fluvial actions. The west-facing dip slopes have gradients of 30 to 50 percent, and the escarpments are somewhat steeper, ranging up to 65 percent. Elevations range from 4,000 to 6,000 feet.

Soils are dominantly shallow and moderately deep but generally have a clay loam subsoil. These soils have more strongly expressed horizon development than those formed on granitic materials. Fertility is moderate, and erosion hazards are moderate to high. The underlying basaltic bedrock is quite variable as to weathering, hardness, and fracturing.

Overland flow is infrequent and confined to steeper slopes. Subsurface flow and deep seepage are the dominant means of excess water removal. Infiltration and percolation rates are moderate to moderately slow.

The vegetative cover on these lands varies from open grass communities to Douglas fir/ninebark and Douglas fir/elksedge habitat types. Herbage productive potential is low to moderate. Timber productivity is moderate. Limitations for reforestations range from slight to severe. Dominant limitations are adverse climate, vegetative competition, and high evapo-transpiration ratios.

These lands are valuable for the production of timber, forage, and seasonal water yields. The finer textured soils will have poor traffic-ability when wet. They are also subject to mass failure when used as fill slopes in road construction but only on localized spots that have high clay accumulations and subsurface water.

Grand fir/spiraea occupies much of gentle terrain with deeper soils and southerly aspects. Adjacent cooler sites are usually grand fir/tall huckleberry with small inclusions of grand fir/queencup on moist protected sites. Minor amounts of alpine fir/tall huckleberry and alpine fir/pine-grass are found at the upper elevations in similar areas.

Where soils are too dry for grand fir, Douglas fir is the dominant tree. Here Douglas fir/ninebark occupies most northerly aspects with Douglas fir/spiraea or Douglas fir/common snowberry on the warmer sites.

In this subsection are many low knobs and basalt outcrops with shallow droughty soils. Here, a complex of xeric communities are found which include ponderosa pine and Douglas fir/bluebunch wheatgrass, bluebunch wheatgrass/Sandberg's bluegrass, big sagebrush/bluebunch wheatgrass, and undetermined associations dominated by Eriogonum spp. Soil depth and development, orientation and extent of bedrock fracturing, slope, and aspect are the main factors governing vegetal communities on these sites.

Average annual precipitation ranges from 25 to 45 inches and runoff from 5 to 20 inches. The following shows the range in precipitation that can be expected from 6- and 24-hour storms with selected expected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)
2	24	1.8-2.2
10	24	2.6-3.0
25	24	2.8-3.6
10	6	1.3-1.7
25	6	1.7-2.0

The chief challenges to management of this area involve utilization of relatively high timber values while protecting relatively high value stream habitats and medium dispersed recreational values. Subsurface moisture concentration zones also constitute a potential road failure problem if unrecognized.

Subsection 3 - Sturgil Peak Subsection

Sturgil Peak Subsection is about 250,000 acres consisting of a moderate to steeply sloping, dissected, uplifted plateau with Columbia River basalt at lower and moderate elevations and Permian-Triassic volcanics at high elevations with scattered intrusions of Idaho Batholith granites. Elevations range from 3,000 to 7,500 feet. At upper elevations, weak glaciation and weak frost churning are the dominant processes with fluvial processes at middle and lower elevations dominating. Some areas exhibit strong structural control. Vegetation consists of ponderosa pine and Douglas fir at low and mid-elevations with a few areas of sage and grass at high elevations. Soils are medium and moderately fine textured Mollisols, Inceptisols, and Entisols with varying depth and stoniness. The following are the dominant landtype associations:

1. Basaltic Glaciated Lands
2. Frost Churned (cryic) Basalt Uplands
3. Plateau Lands
4. Volcanic Fluvial Lands
5. Depositional Lands

North slope Douglas fir/ninebark is a prominant feature of this subsection with Douglas fir/spiraea or Douglas fir/common snowberry on warmer, drier aspects. In the same area, small amounts of ponderosa pine/bluebunch wheatgrass and ponderosa pine/Idaho fescue occur as inclusions within the Douglas fir zone on low knolls and ridges. In many cases, however, the ponderosa pine zone is too narrow to be easily recognized and various mountain shrub communities often border the Douglas fir zone. Chokecherry, mountain snowberry and bitterbrush are major components of the mountain shrub communities. In other areas, the mountain shrub zone is missing and bluebunch wheatgrass/Sandberg's bluegrass and bluebunch wheatgrass/Idaho fescue are common. Several lithosolic communities dominated by Artemisia rigida or Eriogonum spp. and Sandberg's bluegrass also appear sporadically throughout the area.

A minor grand fir zone appears on sites more mesic than Douglas fir climax and most grand fir sites in this subsection have been called grand fir/spiraea. In general, this subsection contains much floristic and vegetal chaos but the grand fir communities are especially atypical of Idaho. It is suspected that this area represents a major transition to the vegetation of central and eastern Oregon.

The following shows the range in precipitation that can be expected from 6- and 24-hour storms for several return intervals. Average annual precipitation ranges from 15 to 30 inches with 5 to 10 inches runoff.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.8-2.4	
10	24	2.6-3.4	
25	24	2.6-3.8	4.0
10	6	1.5-1.8	
25	6	1.6-2.1	

Chief challenges to the management of lands in this subsection are chiefly associated with grazing management first and proper management of a medium to low timber producing potential. There are localized landslide problems which affect road location and design. The area has a relatively high potential for upland game birds, but relatively low general recreational values.

A typical view of the Hornet Plateau Subsection (VIII-4).

Subsection 4 - Hornet Plateau Subsection

The Hornet Plateau Subsection is about 300,000 acres of gently sloping, weakly to moderately dissected plateau of Columbia River basalt.

Meadows Valley is included in this subsection. Elevation ranges from 4,000 feet in the valley to 8,000 feet at Smith Mountain. Dominant relief, however, is 2,000 feet or less.

Although the bedrock is dominantly basalt, small intrusions of granitics do occur and "border zone" rocks are found in the southeast portion of the area. Permian-Triassic volcanics are also found in places near the northern and western boundaries.

The dominant landtype associations are as follows:

Frost Churned (cryic) Uplands		15%
Basalt Plateau and Dip Slope Lands	Open	20%
	Timbered	25%
Fluvial Basalt Lands	Open	10%
	Timbered	15%
Depositional Lands		15%

Soils are dominantly moderately deep loamy skeletal (more than 35 percent rock fragments) and fine loamy but range from shallow to deep coarse loamy to clayey, nonskeletal to skeletal, nonxeric to xeric.

As in Subsection 3, this unit contains numerous outcrops of basalt scablands, especially in the southwestern portion of the area. These lithosolic communities are similar to those mentioned in Subsection 3 as are the grassland communities that appear near lower timberline.

Ponderosa pine and Douglas fir/common snowberry commonly occur here with Douglas fir/ninebark on cooler, more mesic sites. Lesser amounts of Douglas fir/pinegrass can be found on adjacent upper slopes and ridges. In the northern end of this unit, grand fir frequently appears on northerly aspects with deep soils. In many cases these sites are the grand fir/queencup habitat type as opposed to the grand fir/tall huckleberry more common in units 1 and 2. Also the spiraea understory commonly found beneath Douglas fir and grand fir farther south is relatively rare here.

At upper elevations and along cool stream terraces, alpine fir often appears in the alpine fir/queencup habitat type, a situation most common in the northern end of this unit.

Average annual precipitation ranges from about 20 to 35 inches and runoff from less than 10 to about 20 inches. The following shows the range in precipitation that can be expected from 6- and 24-hour storms for selected expected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.8-2.2	1.6
10	24	2.4-3.0	3.4
25	24	3.0-3.6	2.8&3.8
10	6	1.4-1.8	
25	6	1.7-2.2	

Challenges to management in this subsection are considerable because it has some of the highest consumptive resource values on the Payette National Forest. Timber, grazing, and big game potentials are moderately high to high and some of the area is highly mineralized. Recreational values are chiefly associated with hunting (some fishing) and "scenic-loop" driving.

Hells Canyon Subsection (VIII-7) near the Seven Devils area.

Hells Canyon Subsection (VIII-7) near Klemschmidt Grade.

Subsection 7 - Hells Canyon Subsection

The Hells Canyon Subsection is a portion of the Snake River Canyon approximately 400,000 acres and extends from about 8 miles west of Weiser to about 4 miles northwest from Triangle Mountain. In the land system hierachy it is actually more like a landtype association, but because of its large extent and rejuvenated slope(s) characteristics, it is treated here as a subsection. It has a maximum relief of about 5,000 feet (from 2,000 to 7,000 feet elevation).

Cook (1948) reviewed some of the reasons for the extreme entrenchment of the Snake River in Hells Canyon as follows:

> Livingston's hypothesis (1928) of initiation of the present Snake River in post-Miocene time by capture of southward drainage by a tributary of the Salmon working headward to the south, has much to commend it. The straight-line segmentation, deeply incised channel, steeper gradient, and lack of barbed tributaries of the Snake River in Hells Canyon north of the Oxbow contrast enough with the barbed tributaries, flatter gradient, shallower and more curved canyon south of the Oxbow to suggest a different history for the two parts of the river.
>
> It is thought that the first capture occurred a few miles north of the Oxbow and that, subsequently, an arm of the rising, early Pleistocene Lake Idaho, extending northward from the main lake in southern Idaho, spilled over a drainage divide at the Oxbow. Idaho Lake then had an outlet and rapid downcutting drained the lake, reversed the drainage south of the Oxbow, and cut the inner, deeper part of Hells Canyon. As the new Snake River reduced the size of Lake Idaho, the lessened evaporation from the smaller lake surface increased the discharge, which further accelerated the downcutting. Idaho Lake probably formed as a result of uplift gradually blocking the old Snake River passage to the sea, which may have been via northern California. At its maximum, Lake Idaho probably lost more water by evaporation than the Snake now carries; in order to make the lake overflow at the Oxbow, then, the climate must have been considerably more humid than it is now. This conclusion, and the occurrence in several places of abundant glacial outwash gravels just above the highest lake level (3,000-3,500 feet), suggest that the spillover of Lake Idaho occurred during one of the Pleistocene stages of continental glaciation preceding the latest (Wisconsin) stage.

Bedrock is chiefly volcanic with Triassic sediments exposed in the deeper portions of the canyon. Where protected, Columbia River basalts form a cap over Seven Devils volcanics. The area becomes increasingly dissected from south to north. Slopes are dominantly steep and rejuvenated.

Soils are dominantly moderately deep, stony, loamy to fine, loamy with dark surface horizons. Rock outcrop is common in places.

The predominant vegetation in this subsection is nonforested. The more important types include the bluebunch wheatgrass/sandberg bluegrass, the bluebunch wheatgrass/Idaho fescue and the three awn/sandberg bluegrass.

Two primary timber types occur at higher elevations, the ponderosa pine/bluebunch wheatgrass and the ponderosa pine/bitterbrush. In small pockets on north-facing slopes, the Douglas fir/pinegrass and the Douglas fir/ninebark are present.

Average annual precipitation ranges from 25 to about 22 inches with runoff from 1 to 10 inches. Figure 1 shows the range in precipitation that can be expected from 6- and 24-hour storms for selected expected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.2-2.1	
10	24	2.0-3.0	3.2
25	24	2.2-3.0	
10	6	1.2-1.6	
25	6	1.4-1.6	

Challenges to management in at least a portion of it may be associated with maintaining its wild river characteristics. Many of the slopes on the Idaho side at least have medium to high forage producing potentials which makes it a particularly high value area for wildlife including big game (winter range) and upland game birds. Road location, design, and construction problems are particularly difficult in the area.

Subsection 8 - Seven Devils Subsection

The Seven Devils Subsection is about 180,000 acres of extremely steep, strongly uplifted and alpine glaciated mountain ridge system. Elevation ranges from about 3,000 feet on the Little Salmon River to over 9,000 feet at He Devil. Dominant relief is about 3,000 to 3,500 feet (mostly between 8,000 and 4,500 feet elevation).

It is bounded on the east and west by Hells and Salmon River Canyons, on the south by the basalts of the Hornet Plateau Subsection and by the dissected basalt plateau remnant of the Triangle Mountain Subsection on the north.

Bedrock is mainly volcanics with localized granitic intrusions and metamorphics. The volcanic area is chiefly Permian-Triassic complex.

The oldest rocks in the region, Permian to Triassic in age, comprise a thick series of clastic and volcanic rocks, including andesitic flows and tuffs metamorphosed to greenstones, rhyolitic flows, waterlaid volcanic grits and conglomerates, quartzites, lenses of impure limestone, and small intrusive bodies. Because the metamorphosed andesitic rocks predominate, the most common rock colors are dark green to black; some of the tuffs are reddish purple, the quartzitic rocks are pale green or gray, and the rhyolites are gray to almost white. The thickness of this group is difficult to estimate; it probably exceeds 10,000 feet.

Columbia River Basalts still cap some of the area in places, particularly near the southern and northern boundaries. "Border zone" rocks are also found near the southeastern boundary.

The following are the chief landtype associations in the area:

Cirque Headlands	20%
Cirque Trough Lands	30%
Frost Churned (cryic) Volcanic Uplands	15%
Volcanic Fluvial Lands	25%
Depositional Lands	5%
Basalt Table Lands	5%

Habitat types in the area range from whitebark pine/subalpine fir and their associated nontimbered communities at elevations of 8,000 feet and above. Between 7,000 and 8,000 feet subalpine fir/clintonia, subalpine fir/beargrass, and subalpine fir/tall huckleberry are dominant. Grand fir/clintonia is dominant at intermediate elevations with Douglas fir habitat types coming in towards the north at lower elevations. Mountain big sage/wheatgrass dominates the open slopes.

Average annual precipitation ranges from 15 to 45 inches and runoff from 10 to 30 inches. The following shows the range in precipitation from 6- and 24-hour storms that can be expected from selected expected return intervals.

Storm Interval (Years)	Storm Duration (Hours)	Range in Precipitation (Inches)	Small Inclusions
2	24	1.8-2.2	2.4
10	24	2.4-3.0	
25	24	2.6-3.4	3.8
10	6	1.4-1.8	
25	6	1.6-2.2	

The challenges to managing these lands for the future will be considerable. It is a highly mineralized zone with high to very high scenic, recreational, wildlife habitat, water producing, and low to medium timber values. The potential for conflicting uses is higher than average on the area.

Musselshell Basalt Land Subsection in Tri-State Uplands Section of Columbia Intermontane Province (IX-1). The drainage is Elk Creek.

LEGEND

Physiographic Province Boundary

Section Boundary

Subsection Boundary

LAND SYSTEMS OF THE IDAHO BATHOLITH

Northern Rocky Mountain Province

I. Southern Batholith Section

1. Smiths Prairie and Foothills Subsection (complex).
1a. Danskin Mountains Subsection.
2. Trinity - Soldier Mountain Foothills (complex).
3. Middle Fork Boise River Canyon and Streamcut Lands Subsection.
4. South Fork Boise River Uplands.
5. Upper South Fork Boise River Streamcut Lands.
6. Smoky Mountain Trough Lands Subsection.
7. Montezuma Fault Lands Subsection.
8. Sawtooth Foothills Subsection.
9. Lowman Uplands Subsection.
10. Boise Basin Subsection.
10a. Boise Ridge-Payette Canyon Lands Subsection.
11. Middle Fork Payette Canyon and Streamcut Lands Subsection.
12. Sawtooth Mountains Subsection.
13. Stanley Basin Subsection.
14. Stanley Uplands Subsection.
15. Pear Valley-Landmark Basin and Uplands Subsection.
16. South Fork-Payette-Canyon and Streamcut Lands Subsection.
17. Long Valley Subsection.
18. Long Valley Foothills Subsection.
19. Upper South Fork Salmon Subsection.
20. Fitsum Peak Subsection.
21. Upper South Fork Salmon River Canyon Lands Subsection (phase).
22. Upper Middle Fork Steep Canyon and Streamcut Subsection.
23. Profile-Monumental Subsection.

II. Challis Section

1. Bellvue Foothills Subsection.
2. Ketchum Subsection.
3. Boulder-Pioneer Subsection.
4. White Clouds Subsection.
5. East Fork Salmon River Subsection.
6. Challis Subsection.
7. Salmon Mountain Subsection.

III. Salmon Uplands Section

1. Granite Mountains Uplands Subsection.
2. Burgdorf Basin Subsection.
3. Chamberlain Basin Subsection.
4. Salmon River Canyon Lands Subsection (phase)
5. Big Horn Craigs Subsection.
6. Panther Creek Canyon Lands Subsection.
7. Panther Creek Basin Subsection.
8. North Fork Salmon Breaks Subsection.
9. West Fork Bitterroot Streamcut Subsection.
10. State Divide Uplands Subsection.
11. Devils Point Weakly Glaciated Lands Subsection.
12. Sabe-Magruder Mountain Moderately Glaciated Uplands.
13. Red River Basin Uplands Subsection.
14. Buffalo Hump Glaciated Lands Subsection.
15. Florence Basin Subsection.
16. John Day Subsection.
17. Dairy Mountain Dissected Plateau Lands Subsection.
18. Lower South Fork Clearwater Strongly Dissected Lands Subsection.
19. Elk City Basin and Uplands Subsection.
20. Selway Moderately Dissected Lands Subsection.
21. Copper Butte Dissected Glaciated Lands Subsection.
22. Running Creek Streamcut Lands Subsection (phase).

IV. Locsha Uplands Section

1. Selway-Locsha Canyon Lands Subsection.
2. Clearwater Uplands Subsection.
3. Craigs Alpine Glaciated Lands Subsection.
4. Moose Creek Headlands Subsection.
5. Bitterroot Glacial Modified Subsection.
6. Lolo Rolling Uplands Subsection.

V. Bitterroot Front Section

1. East Slope Bitterroot Range Subsection.
2. West Slope Bitterroot Range Subsection.

VI. St. Joe-Clearwater Section

1. North Fork Clearwater Rejuvenated Canyon Lands Subsection.
2. Deception-Hoodo Basin and Uplands Subsection.
3. Bitterroot Strongly Glaciated Lands Subsection (phase).
4. Lolo Strongly Dissected Lands Subsection.
5. Wade Peak Subsection.
6. Upper St. Joe Strongly Dissected Lands Subsection.
7. Sisters Basin and Uplands Subsection.
8. Marble Mountain Strongly Dissected Uplands Subsection.
9. Baby Grand Low Relief Uplands Subsection.
10. St. Joe Thrust Fault Lands Subsection.

VII. Open Northern Rockies Section

1. Hughes Point-Saddle Mountain Subsection.
2. Gibbonsville Subsection.
3. Salmon-Bitterroot Range Subsection.
4. Salmon Lowlands Subsection.

Columbia Intermontane Province

VIII. Wallowa-Seven Devils Section

1. Round Valley Subsection.
2. Council Mountain Subsection.
3. Sturgil Peak Subsection.
4. Hornet Plateau Subsection.
5. Boise-Foothills-Squaw Butte Subsection.
6. Weiser Valley and Foothills Subsection.
7. Hells Canyon Subsection (phase).
8. Seven Devils Subsection.

IX. Tri-State Uplands Section

1. Musselshell Basalt Lands Subsection.
2. Triangle Mountain Subsection (phase).

X. Eastern Snake River Plain Section

XI. Malheur-Boise-Kinghill Section

XII. Owyhee Section

XIII. Blue Mountains Section

Compiled by John F. Arnold

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